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BY MARIO BEZZI,

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There has been some disagreement among Dipterologists about the use of the generic name *Urophora* Robineau-Desvoidy. Coquillett, in his "Type-species of the North American Genera of Diptera"[1] cites *Musca cardui* Linnè, as the type-species of *Urophora*, by designation of Westwood in 1840,[2] although Latreille in 1810[3] had previously selected *Musca cardui* as the typical species of his genus *Tephritis*. Again in 1856, Rondani[4] indicated *Musca solstitialis* Linnè as the type of *Urophora*, which species is now considered congeneric with *Musca cardui* Linnè. Furthermore, Latreille in 1805[5] cites *Musca solititialis* under his genus *Tephritis*, which species Coquillett, in the above mentioned work (p. 613), designates as the type of *Tephritis*.

[1] Proc. U. S. Nat. Mus., XXXVII, p. 619, 1910.

[2] Introd., II, Syn., p. 149, 1840.

[3] Cons. Gen., p. 444.

[4] Dipt. Ital. Prod., I, p. 110.

[5] Hist. Nat. Crust. Ins., XIV, p. 389. In a previous volume (IV) although the genus is described, there are no species.

The consequence of these facts was that the genus *Urophora* Robineau-Desvoidy, 1830, became a synonym of *Tephritis* Latreille, 1805, both having the same type species. This view was accepted by Hendel in 1914, in his two very important works on the genera of the Fruit-flies[6] and on the South American Fruit-flies[7] and was unfortunately followed by me in my paper on the Ethiopian Fruit-flies.[8]

Now, however, all the above procedure has been proven invalid by the fact, as shown by Cresson in 1914,[9] that the genus *Tephritis* appeared in print for the first time in 1804,[10] with the citation of two species, *Musca arnicae* and *Musca cerasi*. Therefore one of these species is the only available type species of the genus *Tephritis*. As the second species, *Musca cerasi*, had been selected as the type species of *Rhagoletis* by Loew in 1862,[11] the first species, *Musca arnicae*, becomes by elimination the type of the genus *Tephritis* Latreille, even in spite of the selection by Latreille himself in 1810 of *Musca cardui*.[12]

The generic name *Urophora*, type species *Musca cardui*, is therefore again to be used in its well known Loewian sense.

Loew in his comparison between the European and American species of Trypaneidae[13] states that there are no species of *Urophora* in the Americas, those described by the European authors under this generic name belonging to other genera, or are not Trypaneidae at all, but Ortalidae with banded wings. The three species recorded in Aldrich's Catalogue of 1905, are to be excluded; indeed the genus *Urophora* is not comprised in the various editions of Williston's Manual.

[6] Wien. Ent. Zeit., XXXIII, p. 90.

[7] Abhandl. u. Ber. d. K. zool. u. anthr.-ethnogr. Mus. zu Dresden., XIV, (1912), p. 31, 1914.

[8] Bull. Ent. Res., IX, p. 15, 1918.

[9] Ent. News, XXV, p. 277.

[10] Nouv. Dict. d. Hist. Nat., XXIV, Tab. Method., p. 196.

[11] Monogr. Tryp., p. 44. Enderlein, Wien. Ent. Zeit., XXXIII, p. 228, 1914, has shown that *M. cerasi* has become, by elimination, the type species of the genus *Trypeta* Meigen 1803 (*Euribia*, 1800).

[12] [The genotype of *Tephritis* Latreille, 1804, has been validly designated by Cresson in the above mentioned paper of 1914, p. 278. The fixation by elimination is therefore unnecessary, and furthermore this method is not used nor approved by zoologists in general, nor is it sanctioned by the International Code. Ed.]

[13] Mon. Dipt. N. Amer., III, p. 331, and note 1.

This absence of *Urophora* from the American faunas was believed to be true until the year 1914, when Hendel described two species of the genus from Peru,[14] and recorded a third, unnamed species from Sitka, Alaska. It seems that this genus is not rare in the higher mountainous districts of South America. Becker indeed has described three species from Ecuador,[15] collected by Rivet, in altitudes ranging from 2800 to 4780 meters. Likewise one of Hendel's species was found by Schause at Tarma, 3000 meters, and that to be described here comes also from the Andean Montaña.

At least one species can be recognized from the United States, namely *Rhagoletis caurina* Doane [16] from Oregon, and listed by Cole and Lovett.[17] This species was hypothetically arranged by me[18] in the genus *Myopites*, but it is certainly a true *Urophora*, closely related to *acompsa* Hendel.[19]

The known American species of *Urophora*, with the addition of the new one here described, can be distinguished as follows:

1 (2). Scutellum entirely yellow; abdomen of a dull black color, not at all metallic; wings with a rather broad fuscous pattern on the apical part; large species 8–9 mm. (fig. 1) . *unica* Becker

[14] *Tephritis acompsa* Hendel, Abhandl. u. Ber. d. K. zool. u. anthrop.-ethnogr. Mus. zu Dresden, XIV, (1912), p. 31, pl. II, fig. 22, and *T. mamarae* Hendel, l.c., p. 32.

[15] *Urophora unica* Becker, Mission du Serv. Geogr., X, 1919, p. 191, pl. XVI, fig. 5; *U. disjuncta* Becker, l.c., p. 191, pl. XVI, fig. 9, and *U. simplex* Becker, l.c., p. 192, pl. XVI, fig. 8. This paper of Becker's was written in 1913, printed in 1914, but was not distributed until 1919, in the following work: Mission du Service Geographique de l'Armee pour la Mesure d'un Arc Meridien Equatorial en Amerique du Sud. Sous le Controle Scientifique de l'Academie des Sciences, 1899–1906. Tome X, Entomologie-Botanique, Fasc. 2, Opiliones, Dipteres, Myriapodes, pp. 121–275, pls. XIII–XXII. Paris, Gautnier-Villers. 1919.

[16] Journ. N. Y. Ent. Soc., VII, p. 182, pl. III, fig. 5, 1899.

[17] An Annotated List of the Diptera (Flies) of Oregon, Proc. Cal. Acad. Sci., XI, p. 325, 1921.

[18] Bull. Labor. Zool., Portici, V, p. 12, 1910.

[19] Some American species described under the generic name of "*Siplographa*," show a wing pattern very similar to the American species of *Urophora*, but they are readily distinguished by the form of the anal cell, and of the prevailingly rufous color of the body, for example, *Spilographa rufata* Van der Wulp, from Mexico.

2 (1). Scutellum with black sides, or sometimes entirely black; abdomen shining black or greenish metallic tints; wings with narrow, dark streaks or sometimes unspotted; smaller species, 2–5 mm.

3 (12). Scutellum yellow with black sides; wings with a more or less distinct pattern.

4 (7). Wings with a complete narrow cross-band, extending from the stigma across the small cross-vein to the hind border; basal cross-veins not infuscated; femora black or black vittate; lunula white.

5 (6). Anterior femora and all the tibiae yellowish; wings with but one black stripe into the marginal cell and with a small apical spot (fig. 2) ..... *acompsa* Hendel

6 (5). Femora and tibiae almost entirely black; wings with two black stripes into the marginal cell, and with a broad apical spot ..... *townsendi* new species

7 (4). Wings destitute of such a band.

8 (9). Legs with the femora blackened at bases; wings with the basal cross-veins infuscated and with numerous blackish stripes (fig. 5) ..... *caurina* Doane

9 (8). Legs quite yellowish; basal cross-veins of the wings not infuscated, and with only a few, rather pale stripes.

10 (11). Wings with fuscous spots at the ends of the third and fourth veins; ovipositor much shorter than the abdomen (fig. 4) ..... *mamarae* Hendel

11 (10). Apex of the wings not spotted; ovipositor much longer than the abdomen (fig. 6) ..... *disjuncta* Becker

12 (3). Scutellum quite black; wings wholly unspotted, with the stigma yellowish (fig 7) ..... *simplex* Becker

Urophora townsendi new species (Pl. I, fig. 3.)

Very near *acompsa* Hendel, and perhaps only a variety of that species; distinguished by the richer wing pattern and the darker legs.

Type.—♂; Rio Charape, Peru, collected by C. H. T. Townsend (in whose honor this insect is named), [deposited in the collection at the Academy of Natural Sciences of Philadelphia, no. 6251]. *Paratype.*—1 ♂, in the author's collection.

Length of body, 4.5 mm.; of wings, 4.5 mm. Head entirely reddish, with black, rather shining occiput, and with a small black ocellar dot. Frons broad, with parallel sides, rather prominent above but rounded, entirely of a dark orange opaceous color; the rather large lunula is white, shining. Para-

facialia shining, narrow; peristomalia much broader, about as broad as the length of the third antennal joint; mouth broader, not prominent, with some short hairs at sides. Antennae entirely reddish, inserted above center line of eyes, with the third joint rounded at tip, not distinctly concaved above, about twice as long as broad; arista bare, thickened basally. The short proboscis and the palpi are yellowish, the latter with dark tips. All the hairs and the bristles of the head are black; the ocellar bristles are very long; only two pairs of lower orbitals; those of the occipital row are rather short; genal bristle proportionally long and strong.

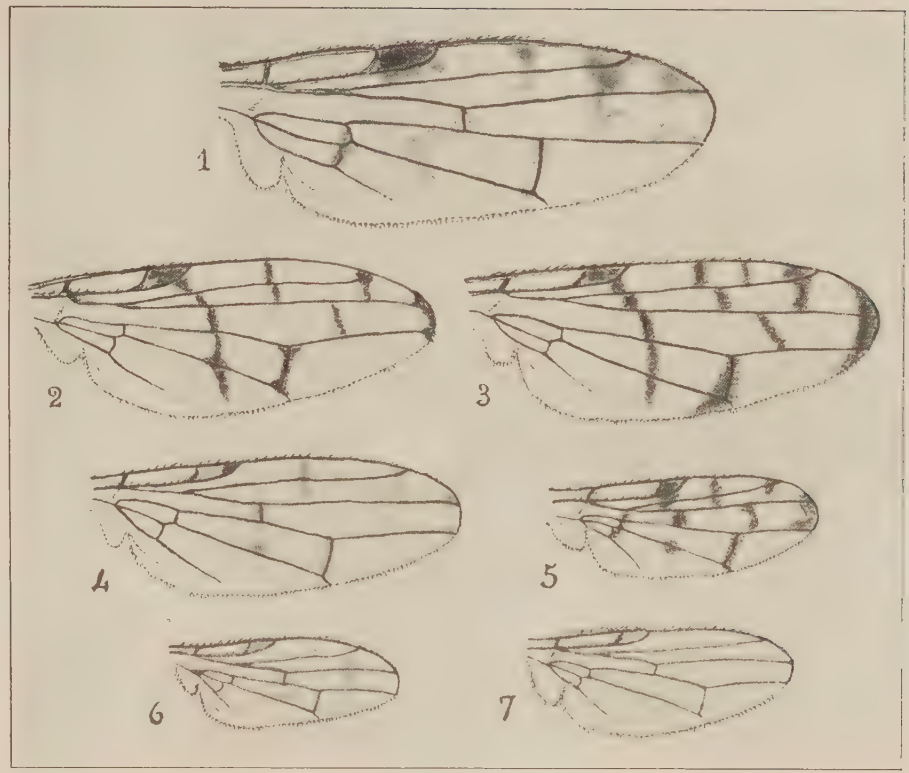
Thorax black with reddish humeri and notopleural stripe extending from humeri to root of wings. Mesonotum opaceous, densely clothed with yellowish-grey tomen; on its anterior half there are three dark, narrow, longitudinal stripes, the middle one abbreviated behind. Pleura shining black, with a faint whitish dust on the sternopleura. Hairs of mesonotum short and black; the pleura quite bare, with only a few black hairs at hind margin of mesopleura. Chaetotaxy complete, with black bristles; dorso-central pair placed before the line of the anterior supra-alars, the praescutellar pair being removed from the hind border of mesonotum; one mesopleural and one sternopleural bristle. Scutellum rather flattened but with no distinct lateral keels; shining yellow, with black sides; the four bristles are black and long, those of the apical pair decussate and as long as the basal ones. Calypters dark. (Halteres wanting in these specimens.) Postscutellum yellowish above but the mesophragma shining black. Abdomen shining black, almost metallic tinged, with distinct greenish reflections, its hairs and bristles are black; venter also black; genitalia brownish-black. Coxae blackened, reddish behind, with greyish dust; trochanters reddish; femora shining black with yellowish tips; tibiae black with yellowish extremities, tarsi yellowish with blackish apices. All hairs, bristles and spurs of middle tibiae, black; fore femora with a complete row of bristles above, and with a row of three to five much longer bristles below on the distal half; hind femora with some bristles below, with a long one in same row at the apical third. Wings rather narrow and long, hyaline with blackish stigma and with numerous blackish streaks forming a characteristic pattern as in figure 3. The veins are black, yellowish towards the base of wing. The stigma is short, narrowly yellowish at base below. First longitudinal vein ending before line of small cross-vein; second vein long; third and fourth veins parallel, the former quite bare; discal cell narrow and long, broadening outwardly, with the small cross-vein placed medianly; hind cross-vein nearly straight, not much longer than the smaller

one, but three times longer than its distance from the inferior margin of wing; axillary vein about as long as the small cross-vein; axillary lobe broad, rounded; alula large.

Explanation of Plate I

All the figures are much enlarged.

Fig. 1.—Wing of *Urophora unica* Becker (after Becker's figure).
Fig. 2.—Wing of *Urophora acompsa* Hendel (after Hendel's figure).
Fig. 3.—Wing of *Urophora townsendi* new species.
Fig. 4.—Wing of *Urophora mamarae* Hendel (after Hendel's figure).
Fig. 5.—Wing of *Urophora caurina* Doane (after Doane's figure).
Fig. 6.—Wing of *Urophora disjuncta* Becker (after Becker's figure).
Fig. 7.—Wing of *Urophora simplex* Becker (after Becker's figure).



BEZZI—THE GENUS UROPHORA IN AMERICA (DIPTERA; TRYPANEIDAE)

NOTES ON THE TAXONOMY, DEVELOPMENT AND LIFE HISTORY OF CERTAIN ACRIDIDAE (ORTHOPTERA)

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I. Introduction

Cytological problems in the Acrididae have demanded data for their completion which could only be obtained through a study of the chromosomal constitution of the parents and the F_1 and F_2 generations. This, of course, involved rearing the animals in the laboratory and keeping them in a thriving condition. Considerable difficulty was encountered at first, and, since the group of short-horned grasshoppers not only furnishes some of the best cytological material so far found, but also has proven excellent for physiological and general laboratory purposes, the information which we have obtained concerning their development and breeding habits may be of interest to others.

The life cycle of a grasshopper consists of three clearly defined stages. 1. Embryonic—from fertilization of the egg till hatching; during this period the rudiments of every adult structure are laid down. 2. Nymphal—from hatching till last molt, marked by differential development of preëxisting structures. 3. Adult—extending from last ecdysis till death. This is the period of sexual maturity; wings reach their maximum development and some arrangement for producing sound is usually present.

II. Technique of Breeding and Rearing

So far as concerns the keeping of the various species in a healthy, vigorous condition, each one is more or less of a law unto itself. Certain general principles, however, apply to all of the sixteen species (distributed through ten genera) reared to date in this laboratory.

The type of cage used is eight and one-half inches high by seven inches long by six inches wide. The frame, top and bottom are made of one-half inch cypress. The front and back are

closely fitting glass plates. The front one is cut about two and one-half inches from the bottom so that the top part may be slipped up to open the cage. The ends are of eighteen to the inch mesh copper gauze except the lower two and one-half inches, which are of cypress. The bottom of the cage will thus hold some two inches of sand. All parts are so close-fitting that the young cannot escape when they hatch.

Twelve to twenty-five young individuals may be kept in such a cage. The amount of care required varies greatly with the hardiness of the species. In general, tryxalines are the most delicate, acridines the most vigorous. For the immature insects, a thin layer of clean, dry sand is kept on the floor of the cage and changed as often as cleanliness demands. Mould must be avoided for most species. When it is time for eggs to be deposited, two inches of sand is placed in the cage and the cages are then dipped in water every week or ten days. After egg-laying has been completed, the egg pods may be obtained, if desired, by passing the sand through a sieve. The pods may then be placed separately in small tubes of aluminum gauze each with a numbered aluminum tag for identification. A number of such tubes can be stored in moist sand in a glass dish some four inches in diameter and two inches deep. Each tube can then be removed to a small dish of sand and placed in a separate cage just before the time for hatching. This method greatly economizes on space and also in the labor of caring for the eggs.

It is essential for normal development that the "hoppers" be kept in a sunny, warm, well-ventilated place. Of these three requirements, sunshine is the most necessary. If it is lacking at the time for hatching the insects may not be able to reach the surface even after leaving the egg, or they may die without emerging from the egg. Another critical time is just before and during the several molts. The effects of deficiency of sunlight at these crucial periods can be avoided to some extent by the use of electric light; preferably a hundred watt nitrogen "day-lite" bulb placed near enough to afford heat as well as light.

As to feeding, the proper food plant or plants should be kept fresh in water in the cages. A comparatively short period of neglect in regard to food interferes with the development of the germ cells, especially the eggs.

(1) *Species Reared*

I Tryxalines

1. *Dichromorpha viridis*
2. *Chloealtis conspersa*

II Oedipodines

3. *Arphia xanthoptera*
   Arphia pseudonietana
4. *Chortophaga viridifasciata*
   Chortophaga australior
5. *Dissosteira carolina*
6. *Encoptolophus sordidus*
7. *Circotettix verruculatus*
8. *Trimerotropis maritima*

III Acridines

9. *Melanoplus differentialis*
   Melanoplus femur-rubrum
10. *Hesperotettix viridis*
    Hesperotettix pratensis
    Hesperotettix brevipennis
    Hesperotettix osceola

(2) *Food Habits*

The first eight genera listed above are primarily grass-eaters; however, certain species have decided preferences for particular kinds of grass. The most useful grasses appear to be the *Poa*. Wheat and millet are satisfactory. Oats, on the contrary, is totally unsuitable. *Chortophaga viridifasciata*, when first hatched, will eat growing oats but dies within a few days. The same species, if first fed on a suitable plant, will continue to grow if transferred to oats and will become adult, but the females fail to develop eggs and the germ cells of the males are abnormal. An undetermined grass is even more deficient; vigorously growing *Arphia pseudonietana* and *Circotettix verruculatus* when transferred to this grass eat it freely but die in a few days, apparently from starvation; even the adults will not survive on it.

Further evidence of differences in regard to acceptable food is furnished by the eagerness with which *Circotettix* and many other grass feeders eat dandelion, yet several species of *Arphia*

will not feed on this plant. Clover and lettuce may be used to advantage as food for certain of the species listed.

The acridines are more hardy. The common species of *Melanoplus* thrive on a variety of plants. The various species of *Hesperotettix* are much more limited as to their food supply. *H. speciosus* (not listed) prefers sun-flowers; *viridis*, a certain species of *Solidago* and *Grindelia sparrosa; pratensis* a different *Solidago,* and *brevipennis* still another. Certain asters may be used as food for most species of *Hesperotettix.* All of the above species of *Hesperotettix* have been reared and have matured their eggs when fed largely on *Aster paniculatus,* which I have never known them to eat when free.

The experienced collector looks for the food plant of the species sought rather than for the animals themselves when starting to collect in a new region. The writer has taken *H. viridis* and *H. pratensis* in a small pasture; *viridis* around *Grindelia*—the *Solidago* which they choose as food not being present, *pratensis* ten yards or so away among the species of *Solidago* which they prefer. Later, in captivity, *pratensis* did not thrive on *Grindelia.*

The foregoing information has been acquired incidentally in rearing the insects. Dr. J. H. Bodine in this laboratory has made a more extensive study of the subject and has growth curves for a number of species on various foods. These will be published later.

III. Egg-laying and Embryonic Development

All of the species involved in this study, except *Chortophaga viridifasciata* and *C. australior,* normally lay eggs in the autumn which hatch the following spring. *Chloealtis conspersa* lays in old wood, preferably fallen branches of trees. The other species lay in earth or moist sand. The latter is most convenient for laboratory use.

As to the number of eggs laid, *Hesperotettix viridis* and *H. pratensis* deposit four to eight eggs in each pod and one female may make six pods. Since the later pods contain fewer eggs than the earlier ones, a given female probably does not lay more than forty eggs. *Circotettix verruculatus* rarely produces more than four pods with perhaps a total of fifty eggs. *Melanoplus differentialis* on the other hand may lay one hundred and fifty-

six eggs (Dr. Bodine's count) in a single pod and since some pods contained seventy to ninety eggs and others as low as thirty-six, it is probable that a single female produces three pods with a total of about two hundred and fifty eggs.

The eggs are elongated and cylindrical; an egg which is 5 mm. long is about one and one-half mm. in thickness. The end which leaves the uterus first is somewhat pointed and contains the micropyle, this is known as the caudal end; the other or cephalic end is bluntly rounded, is placed upward in the pod and corresponds to the head end of the fully developed embryo. The dorsal surface in position in the pod is convex, the ventral concave. The ventral surface of the embryo at hatching occupies the concave side of the egg.

These details are practically the same as those given by Riley[1] for the "Rocky Mountain locust." It should be noted that the egg of the long-horn *Conocephalus ensiferus* (*Xiphidium ensiferum*, of older authors) differs in several respects. Wheeler states:[2]—"The broader pole is the posterior, and is the first to leave the vagina during oviposition; the attenuated pole is, therefore, the anterior. In the galls the eggs stand with their attenuated poles pointing upwards. The convex face of the egg is the ventral, the concave, the dorsal region. Inasmuch as the egg undergoes no change in shape during development, it is easy to orient the embryo in its different stages." The writer has found similar conditions in another species of *Conocephalus*. Hagan,[3] one of Wheeler's students, gives a similar description of the egg of *Paratenodera sinensis* Saussure, but in addition notes a conspicuous micropyle at the anterior end. He, however, does not mention his criteria for determining the anterior end.

According to Wheeler the rudiments of the embryo are formed on the convex side with the head directed towards the pointed end of the egg. The embryo then passes through the yolk and comes to lie on the concave side with the head towards the blunt end of the egg. Later it passes around the blunt end head first and lies with the dorsal part of the embryo on the concave side

[1] On the Natural History of the Rocky Mountain Locust, etc. Bull. U. S. Entom. Comm., no. 2, (1877).

[2] A Contribution to Insect Embryology. Journ. of Morph., VIII, p. 5, (1893).

[3] Observations on the Embryonic Development of the Mantid, Paratenodera sinensis. Journ. of Morph., p. 224, (1917).

of the egg with head to the pointed pole. He gives[4] a diagram with the embryo in this position and states that it is nearly ready to hatch. This seems doubtful as the femur of the hind leg is far from fully developed and there is considerable free space in the egg. So far as the short-horned grasshoppers are concerned, the following points of difference should be borne in mind. The pointed end of the egg is posterior, the convex side dorsal, the head of the embryo, at and for sometime previous to hatching, is towards the blunt end. The form of the embryo shows clearly through the shell and has been correctly figured by Riley,[5] Brongniart[6] and others.

Immediately after hatching the insect molts. Morse[7] and most other students refer to this process as the shedding of the amnion. The pellicle, however, is non-cellular, chitinous and envelopes each appendage separately (see pl. II, fig. 1). The amnion would certainly be cellular. Furthermore, the method of getting free is similar to that of the later molts; e. g. the formation of the cervical ampulla by distending the membrane at the back of the neck with blood, the pumping in of excess air and the muscular efforts cause the coat to split over the prothorax. According to Wheeler the embryo of *Conocephalus* (*Xiphidium*) is evaginated from its amnion at the time of its final revolution and soon afterwards, when the residual yolk has been taken into the mesenteron, a chitinous cuticle is formed over the entire body. This cuticle is shed in the egg and the one shed immediately after hatching is the "second larval cuticle." It would seem that the usual definition of an instar as the period between any two succeeding ecdyces should be limited for practical purposes to those which occur after leaving the egg. The term is so used in this paper.

Most species normally hibernate in the egg. They develop to a certain point and stop until the necessary conditions for further development have been met. At the time of this stoppage the head of the embryo is directed towards the caudal end of

[4] A Contribution to Insect Embryology. Journ. of Morph., VIII, p. 17, (1893).

[5] See footnote 1.

[6] Les criquets pelerins en Algerie. Bull. Soc. Philomatique, Paris, V, (1893).

[7] Manual of the Orthoptera of New England. Proc. Boston. Soc. Nat. Hist., XXXV, no. 6, p. 229, (1920).

the egg as may be seen by the position of the eyes, which are sufficiently pigmented to be visible through the shell. The appendages are also formed but the yolk has not been taken into the mesenteron. No way has been found of forcing development beyond this point. When kept above freezing, eggs of *Chloealtis*, *Circotettix*, *Hesperotettix viridis* and *H. pratensis* have remained at this stage for seventeen months. Numerous embryos sectioned during this period showed scarcely a cell in division. There is little doubt that these eggs would have hatched the second spring had they been kept and put out of doors for the winter. About one per cent of them did hatch the first spring and a greater proportion of the eggs of *Arphia xanthoptera* and *Dichromorpha viridis* have hatched under similar conditions.

On the other hand, *Encoptolophus sordidus*, which also ordinarily passes the winter in the egg, if kept at 22–25° C, completes its development without a pause, hatching in about six weeks, which is the same period required by *Chortophaga* in this locality where the eggs are normally laid in the late spring and hatch during the summer. In this vicinity, there is but the one brood of *Chortophaga viridifasciata* a year; in Kansas there are two broods, and in the laboratory it is feasible to obtain six generations of either species of this genus in a year.

It is thus possible to arrange a series beginning with forms in which there is no "hibernation" in the egg and running up to those where nearly all of the eggs enter this condition. Attempts to produce an artificial winter by alternating the eggs from room temperature to that of an ice box and then to freezing mixtures at as low as -15° C for an hour or more have been so unsuccessful that at present the cages are simply planted out of doors to the depth of their contained sand and left till late January. Eggs brought in at this time will hatch readily between February 15 and 28. Individuals so obtained will become adult within six weeks and two or more pods of eggs may be obtained in another four weeks. Early in June the cages may be planted in a cool, damp place to be left till the ensuing January. Such a procedure is, of course, applicable only to those forms where the tendency to hibernate in the egg is strongly developed. It must be taken into consideration, also, that a species which

has a wide north and south distribution, such as *H. pratensis*, will probably display different habits in this respect according to locality.

It would be most interesting to know the physiological mechanism which comes into play to stop development at a closely corresponding stage in numerous species, and even more so to know why it occasionally fails to operate, so that varying numbers of eggs, according to the species, hatch without this stoppage even though kept above freezing.

Uvarov[8] reports an unpublished breeding experiment of V. Plotnikov on *Locusta migratoria*, a form which normally winters in the egg. One egg from among all those composing five pods hatched about forty-eight days after oviposition. This individual was reared. Other eggs examined at this time contained half grown, hibernating embryos.

Conocephalus ensiferus (*Xiphidium ensiferum*)[9] reaches a similar stage of development within a month after oviposition and remains in this condition until spring, when its embryonic growth is rapidly completed.

IV. Post-embryonic Development

The period from hatching to adult is divided into five instars. The rate of development varies somewhat with the species. The following data are based on eleven families (one hundred and forty-nine individuals) of *Circotettix verruculatus*.

The average length of each instar (time from molt to molt) was as follows:—first $8\frac{9}{11}$ days, second $6\frac{6}{11}$ days, third $7\frac{7}{11}$ days, fourth 9 days, fifth $10\frac{3}{7}$ days. The shortest instar was five days, the longest twelve, the average time for all instars was eight days. The first and the fifth instars are the most critical periods. The average time from hatching to adult was forty-two days, the shortest time was thirty-six days and the longest forty-five. This difference in rate of growth was largely due to variations in amount of food and of sunny weather.

[8] A Revision of the Genus Locusta L. (=Pachytylus, Fieb.), with a New Theory as to the Periodicity and Migrations of Locusts. Bull of Entom. Research, XII, (1921).

[9] Wheeler, W. M. A Contribution to Insect Embryology. Journ. of Morph., VIII, no. 1, (1893).

Two other causes affect viability rather than rate of growth. One is the time of hatching. Under laboratory conditions, eggs brought indoors in January will hatch during the third and fourth succeeding weeks. The great majority will hatch on some particular warm, sunny day. The time of emerging is usually near noon. Other pods will hold over till the fifth or sixth week and while all of the individuals may hatch, they have a shrunken appearance and most of them die without starting to eat. Such late hatching specimens contain very little yolk and their death is doubtless due to starvation, since those which appear at the height of the hatching period are filled with yolk.

The other cause known to lessen viability in *C. verruculatus* is a hereditary one. Lack of viability is known in one strain (stock from a given locality) to be associated with a particular condition of the eighth pair of chromosomes. This subject will be taken up in another paper. It seems desirable here, however, to call attention to the fact that certain families are much more hardy than others.

Plate III shows the nymphal changes in *C. verruculatus*. The photographs were made at two magnifications. Figures 1 to 6 are in one series and figures 7 to 11 in the other. The difference of enlargement between the two series may be seen at a glance by comparing figures 6 and 7 (the same specimen at the two magnifications). Each instar is represented by two photographs. One taken at its beginning, the other, at its close; thus, figures 1 and 2 are respectively of an insect a few hours after hatching and just before the molt which ends the first instar. A comparison of the two figures shows that the abdomen has become considerably extended towards the end of the instar through the extension of the segments. The hind legs, antennae, pronotum and other more heavily chitinized parts, on the other hand, have not changed in size. The color pattern of this species is remarkably constant for the first instar. Such variations as have been found are probably genetic. Just after the molt (fig. 3) the body of the insect is actually shorter than before. It is, however, thicker and the head, thorax, femur, etc. are larger. At the end of the second instar, (fig. 4) while the latter parts have not changed in size, the abdomen again has become fully

extended. A similar series of changes take place during each of the three succeeding instars. The third instar is represented by figures 5 and 6; the fourth by figures 8 and 9, and the fifth by figures 10 and 11.

Plate IV shows the appearance at each instar of a tryxaline, *Chloealtis conspersa* (figs. 12-16) and of an acridine, *Hesperotettix* (figs. 18–22). Figure 23 represents an adult male *H. viridis*.

In all of the species studied, the number of spines characteristic of the adult is present in the hind tibia at the time of hatching. The antennae on the other hand form new segments at the free ends, during the early instars.

Throughout the five instars, four structures notably undergo changes in relative rate of growth in comparison with other parts, which grow at a nearly uniform rate as regards each other. These parts are the antennae, the pronotum, the gonads and the wings. The usual method of comparing the length of the part under consideration with body length is not feasible, since this involves the length of the abdomen which varies with the amount of extension of the segments, both at the will of the insect and as a matter of growth during an instar. The parts under consideration, with the exception of the gonads, change size only at the time of molting. The length of the hind femur has been used, therefore, as the standard of comparison.

(1) *Antennae.* In each of the species studied the length of the antennae, when compared with that of the hind femora, becomes relatively greater with succeeding molts (see table 1).

(2) *Pronotum.* The same may be said of the pronotum of *Circotettix* and of *Hesperotettix* if one takes its greatest length in the mid-dorsal line. The ratio is 3:1 for the first two instars and 2:1 for the fifth. In *Chloealtis* the ratio is 3:1 regardless of stage of development; also the ratio of the greatest length of the pronotum to the length of its narrowest part remains practically constant, about 1.4:1, whereas this ratio in *Circottetix* and *Hesperotettix* changes from 1:1 at the first instar to 2:1 at the fifth. In other words, the pronota of the last two species change in shape during the growth of the nymph, while the pronotum of a newly hatched *Chloealtis* is practically the same shape as that of the adult. A further analysis shows that in the first two genera the prozona grow at a practically uniform rate, while

the rate of growth of the metazona is augmented from the beginning of the third instar. It follows, of course, that the position of the principle sulcus (suture between the prozona and metazona) varies from instar to instar, hence this character cannot be used for identification purposes during the nymphal stages.

	Ratio	1st	2nd	3rd	4th	5th	Adult
Chloealtis	Femur : wing	7:1	7:1	7:1	5:1	3:1	1.6:1
Circotettix	" : "	6:1	6:1	4.5:1	2.3:1	1.5:1	.4:1
Hesperotettix	" : "	6:1	6:1	6:1	4:1	2:1	.7:1
Chloealtis	Femur : Antennae	1.8:1	1.5:1	1.5:1	1.4:1	1.3:1	1.1:1
Circotettix	" : "	1.8:1	1.75:1	1.5:1	1.3:1	1.25:1	1.2:1
Hesperotettix	" : "	3:1	3:1	2:1	1.7:1	1.6:1	1.5:1
Chloealtis	Femur : Crest of pronot-	3:1	3:1	3:1	3:1	3:1	3:1
Circotettix	" : " um	3.5:1	3:1	2.5:1	2:1	2:1	2:1
Hesperotettix	" : "	3:1	2.5:1	2.5:1	2.4:1	2.3:1	1.7:1
Chloealtis	Crest : narrowest	1.4:1	1.4:1	1.4:1	1.4:1	1.4:1	1.4:1
Circotettix	of pro- : part of	1:1	1:1	1.5:1	1.7:1	2:1	2:1
Hesperotettix	notum : pronotum	1:1	1:1	1.3:1	2:1	2:1	2:1

Table I. Shows the ratio of change in three genera in rate of growth of wings, antennae and pronotum in comparison with length of hind femora at each instar.

(3) *Tegmina and Wings.* At the first instar the developing tegmina and wings cover the ventral edges of the mesonotum and metanotum respectively (pl. II, figs. 1 and 2 a, b). The venation is already indicated. At the second instar, the venation is more marked, and at the third a more rapid growth is inaugurated so that the tips are prolonged backwards and downwards. During the first three instars tegmina and wings are in the position and relation to each other that they occupy in the adult. As the insect enters the fourth instar, the tegmina and wings become reversed in all respects. They are raised and turned back dorsally so that the inside is outward, the ventral edge is dorsal, and the tegmina are median to the wings. This relation is maintained during the fifth instar. The rate of growth relative to other structures becomes steadily more rapid. Thus (as may

be seen in table I) during the first three instars, the hind femora of *Circotettix* are about six times as long as the wings; at the fourth the ratio is reduced to 2.3:1 and at the fifth it is 1.5:1. It may be noted that in *Hesperotettix* where the wings are only moderately well developed in the adult, the ratio is again 6:1 for the early instars and slightly less, (2:1) at the fifth, while in *Chloealtis* females, which are brachypterous as adults, the ratio is 7:1 in the first instar and 3:1 in the fifth. That is, in the long winged *Circotettix* the length of wing in comparison with the length of the femur is twice that in the brachypterous form in the fifth instar.

The development of the wings is well shown by the exuvia, of which a series of photographs are given (plate V, figs. 37 to 40 and plate IV, fig. 17). The tegmina are marked "a," the wings "b." These photographs of the exuvia together with those of the first instar, particularly plate II, figure 2 (a and b) show clearly that even when hatched, both tegmina and wings are entirely free from the mesothorax and metathorax except at the joints. Anyone may ascertain this fact for himself with a newly hatched grasshopper and a hand-lens or even the unaided eye, yet Morse[10] states, "In the first stage not even the rudiments of tegmina and wings can be seen." Practically all writers on the subject are in agreement with him. It is rather surprising that structures so easily discerned have escaped notice, especially when we consider the amount of work done on the life histories of this economically important group.

Photographs of the last molt with the expansion and arrangement of the wings in *C. verruculatus* are shown in plate V, figs. 24 to 36 inclusive. The hopper suspends himself head downwards by the second and third pairs of feet (fig. 24). Contrary to most writers I find that the femur and tibia form an angle of more than ninety degrees at this time. During the ensuing struggle they are pulled out until they almost form a straight line, as may be seen in the next three pictures (unfortunately the attachment of the foot on the far side became loosened). The elasticity of the cast skin brings the femur and tibia back into the relation usually

[10] Manual of the Orthoptera of New England. Proc. Boston Soc. Nat. Hist., xxxv, no. 6, p. 229, (1920).

figured as soon as the exuvium becomes free (pl. IV, figs. 17; pl. V, figs. 37 to 40). Riley[11] states in regard to the tibia: "They are in fact drawn over the bent knee joint, so that during the process they have been bent double throughout their length." This, so far as my observations go, occurs only when the insect has been disturbed just as it started to molt. As soon as they are freed, the hind tibiae are straightened by being pressed tightly into the groove on the lower side of the femur, where they are held for fifteen minutes or more while the wings are being expanded.

When the hopper is free from the exuvium it turns around and clings to its support with its first two pairs of feet, which have already become hardened enough for use. The wings, which are at first gathered along the principal veins (pl. V, figs. 28, 29), are fully expanded by forcing air into the trachea (pl. V, figs. 30, 31) and then are carefully folded, with frequent stops, while the folds are held in place with the hind legs to harden (pl. V, fig. 32). After they have been completely arranged, they are held in position till somewhat stiffened (pl. V, fig. 33). The time occupied in the various processes of the last molt is divided approximately as follows:

5 minutes to assume position
10 minutes to emerge
15 minutes to expand wings
10 minutes to fold wings
15 minutes to hold wings in position

Any one of the first three molts may be completed in ten minutes.

Two anomalies appeared. Two out of a family of five individuals of *C. verruculatus* attempted to expand their wings at the fourth molt and the color bands also appeared. One of these is shown (pl. V, figs. 35, right side; 36, left side). By comparison with figure 24 on same plate, a normal individual in the same instar, it will be seen that the wings were expanded to some extent. The wing and tegmen of the right side maintained their normal relation for this instar; but on the left side they assumed the relative position characteristic of adults, that is,

[11] On the Natural History of the Rocky Mountain Locust, etc. Bull. U. S. Entom. Comm., no. 2, p. 12, (1877).

the tegmen was on the outside, but both were in the raised position with the inside outward. Both of these individuals died during the fifth molt. The wings, however, were first extracted and appeared normal.

The other eccentricity appeared in some F_1 *Hesperotettix* hybrids (*H. viridis* ♂ × *H. pratensis* ♀). At the fourth molt, three out of seven specimens failed to develop certain color patterns which characterize this stage. The wings appeared normal for the fifth instar but slightly smaller. These individuals went through a sixth instar during which the markings of the normal fifth instar developed. The wings while larger still presented the appearance of the fifth instar. The animals were of normal adult size. Riley has reported the Rocky Mountain Locust as sometimes undergoing an additional molt and the Severins[12] have shown that the mantids vary from four to six molts. The above is the only instance of variation in number of molts which I have encountered in rearing more than a thousand individuals. The additional molt in this case was probably not due to the hybridization, but to a very abnormal environment. The eggs had been subjected to an artificial winter, during the summer, in an attempt to force early hatching. A few of the eggs hatched at the end of September; the remaining ones were kept in a warm room until the first of February, when they were placed out-of-doors for a month. A few of these hatched in two or three weeks after being brought indoors and produced the individuals which underwent an extra molt.

(4) *Gonads.* Finally, we will consider briefly the growth of the gonads. The testes develop earlier in tryxalines and acridines than in oedipodines, so that one finds during the fifth instar of the latter conditions comparable to the fourth instar of the other two. In all, however, the increase in rate of growth seems to start during the third instar. Table I shows that differential growth in general becomes noticeable at the beginning of the fourth instar, though the development which is then expressed, of course, took place during the third instar. It is interesting to note that although the ovaries are relatively undeveloped at

[12] The Effects of Temperature on the Molting of the Walking-stick, Diapheromera femorata Say (Orthop.). Ent. News, XXIV, (1913).

the end of the fifth instar, and rapid growth begins only with the adult phase, nevertheless, differential bodily growth between the sexes begins at the fourth instar and by the end of this instar the females are clearly larger than the males, in species where this distinction exists between the adults.

V. Taxonomic Characters: Time of Their Appearance

A knowledge of the stages of development at which the various characters in general use by taxonomists, reach the condition which they maintain in the adult, is of importance from two standpoints; the practical one of knowing which characters can be used for identification of immature specimens, and the theoretical one that these characters may be the more fundamental ones for use in classifying adults.

General build is apparent within a few minutes after hatching; e. g., the slant face and slender body of the tryxalines, the prosternal spine of the acridines and the crested pronotum of the genus *Arphia*.

The shape and markings of the vertex, position and shape of the foveolae, width of interspace between metasternal foramina and number of spines on hind tibiae are all fixed in these species before the time of hatching. On the other hand, no conclusion as to the antennae of the adult can be drawn from those of the nymph, since shape, number of segments and length relative to other parts vary with development.

Body-length:—Plate III illustrates the change in body-length during each instar. At the beginning of an instar, the hind femora surpass the abdomen, but by the end of an instar, owing to the stretching of the membrane between the segments, the abdomen extends considerably beyond the knee of the hind femora. Measurements show the increase in body-length during an instar to be about thirty per cent. After the last molt a similar increase takes place but it is complicated in the female by the periodic development and discharge of the eggs. For this reason statements like the following " . . . hind femora rather stout, distinctly surpassing tip of abdomen, male; equalling it, female," which are frequent in descriptive literature, are absolutely valueless not only in regard to femora but also the

wings. Wing-length in comparison with length of femur is at least free from the objection that it changes during the adult life of the individual.

Pronotum:—The adult condition of the median carina, as to whether it is entire, cut by the principal sulcus, or by both principal and secondary sulci, is established before hatching. The position of the principal sulcus of the adult, however, cannot be judged from that of the nymph, since the prozona and metazona grow at different rates, beginning, as already described, at the third instar.

Wings:—Obviously characters such as color, width of dusky border and length of spur are only manifest in the wing of the adult. A much used character of the tegmen, position of the intercalary vein, falls in the same category, although I had hoped it might be available for use during the later instars.

Color and Color Patterns:—Many tryxalines and acridines possess in general the ground color of the adult within a few hours after hatching, though certain trimmings appear later; e. g., a *Hesperotettix* can readily be recognized as such (in distinction from other acridines) at the first instar by its green color and white markings. The black edgings of the sutures which characterize *H. viridis* do not appear till the third instar, and the red knee bands appear only twenty-four to forty-eight hours before the last molt. The tint of colors in these two subfamilies often is almost exactly that of the plant on which they feed and usually rest.

In the oedipodines, the color situation is more complex. *Circotettix verruculatus*, as previously mentioned, has a very definite pattern in black and white for the first instar, but with succeeding instars a wide range of color develops, including brick red, brown and green. In the same fraternity living in a small cage, under an identical environment, some individuals will be almost coal black, others a mottled, sandy gray; a fact which points directly to genetical factors as determining the much discussed color phases of this subfamily. First instar nymphs of *Dissosteira carolina* are strikingly marked by having the distal three-fourths of the hind femora solid black. *Chortophaga viridifasciata* with its well known green and brown

phases in the later stages has, with the exception of two individuals, always been brown for the first instar when hatched in the laboratory.

In conclusion, it is believed that the taxonomist who is familiar with the various groups should have little difficulty in placing any nymph in the proper genus, and in many cases even in determining the species. In the genus with which I am most familiar, *Trimerotropis*, wing characters have been largely used in the separation of species; nevertheless, it has been possible by a comparison of other characters, to determine the group of species to which particular nymphs belong.

Explanation of Plates

The individuals photographed for plates III and IV were slightly etherized. Those shown in plate V were normal.

Plate II

Fig. 1.—Photograph of *Dichromorpha viridis* in process of molting immediately after hatching. Note that the skin which is being shed envelops each appendage separately.

Fig. 2.—Camera lucida drawing of portion of above photograph; note tegmen (a) and wing (b) and the cervical ampulla at back of head. These features may be seen with almost equal clearness in the photograph.

Plate III

Circotettix verruculatus

Shows changes from instar to instar and during each instar

Fig. 1.—Beginning of first instar. ×4½±.
Fig. 2.—End of first instar. ×4½±.
Fig. 3.—Beginning of second instar. × 4½ ±.
Fig. 4.—End of second instar. ×4½±
Fig. 5.—Beginning of third instar. × 4½ ±.
Fig. 6.—End of third instar. × 4½±.
Fig. 7.—End of third instar. × 2 ±.
Fig. 8.—Beginning of fourth instar. × 2±.
Fig. 9.—End of fourth instar. × 2±.
Fig. 10.—Beginning of fifth instar. × 2 ±.
Fig. 11.—End of fifth instar. × 2 ±.

Plate IV

Photographs of a tryxaline and an acridine

Figs. 12–16.—Nymphs of *Chloealtis conspersa*

Fig. 12.—First instar. × 5 ±.

Fig. 13.—Second instar. × 5 ±.

Fig. 14.—Third instar. × 5 ±

Fig. 15.—Fourth instar. × 3 ±.

Fig. 16.—Fifth instar. × 3 ±.

Fig. 17.—Fifth exuvium of *Chortophaga*, compare development of wings with that of a fourth exuvium (Plate V, fig. 40).

Figs. 18–23—Nymphs of *Hesperotettix*

Fig. 18.—First instar of *H. brevipennis*. × 4 ±.

Fig. 19.—Second instar of *H. brevipennis*. × 4 ±.

Fig. 20.—Third instar of *Hesperotettix* species. × 4 ±.

Fig. 21.—Fourth instar of *H. viridis*. × 2½ ±.

Fig. 22.—Fifth instar of *H. viridis*. × 2½ ±.

Fig. 23.—Adult male of *H. viridis*. × 2 ±.

Plate V

Figs. 24–36.—*Circotettix verruculatus*

Fig. 24.—In position for fifth molt.

Fig. 25.—Head free.

Fig. 26.—Antennae and first pair of legs nearly free.

Fig. 27.—Front legs in use, wings and second pair of legs free.

Fig. 28.—Position reversed, just free from exuvium.

Fig. 29.—Beginning to spread wings.

Fig. 30.—Wings nearly spread.

Fig. 31.—Beginning to fold wings.

Fig. 32.—Later stage of wing pleating.

Fig. 33.—Wings held in position to harden.

Fig. 34.—Adult.

Fig. 35.—Fifth instar specimen which partially expanded wings—note wing bands, right side.

Fig. 36.—Same specimen, left side, tegmen on outside but reversed in usual position for fifth instar.

Fig. 37.—*Arphia pseudonietana*, cast skin, first molt—Note wing pads (a, b).

Fig. 38.—*Arphia pseudonietana*, cast skin, second molt—Note wing pads (a, b).

Fig. 39.—*Circotettix verruculatus* cast skin, third molt—Note wing pads (a, b).

Fig. 40.—*Circotettix verruculatus*, cast skin, fourth molt—Note wing pads (a, b).

CAROTHERS—NOTES ON CERTAIN ACRIDIDAE (ORTHOPTERA)

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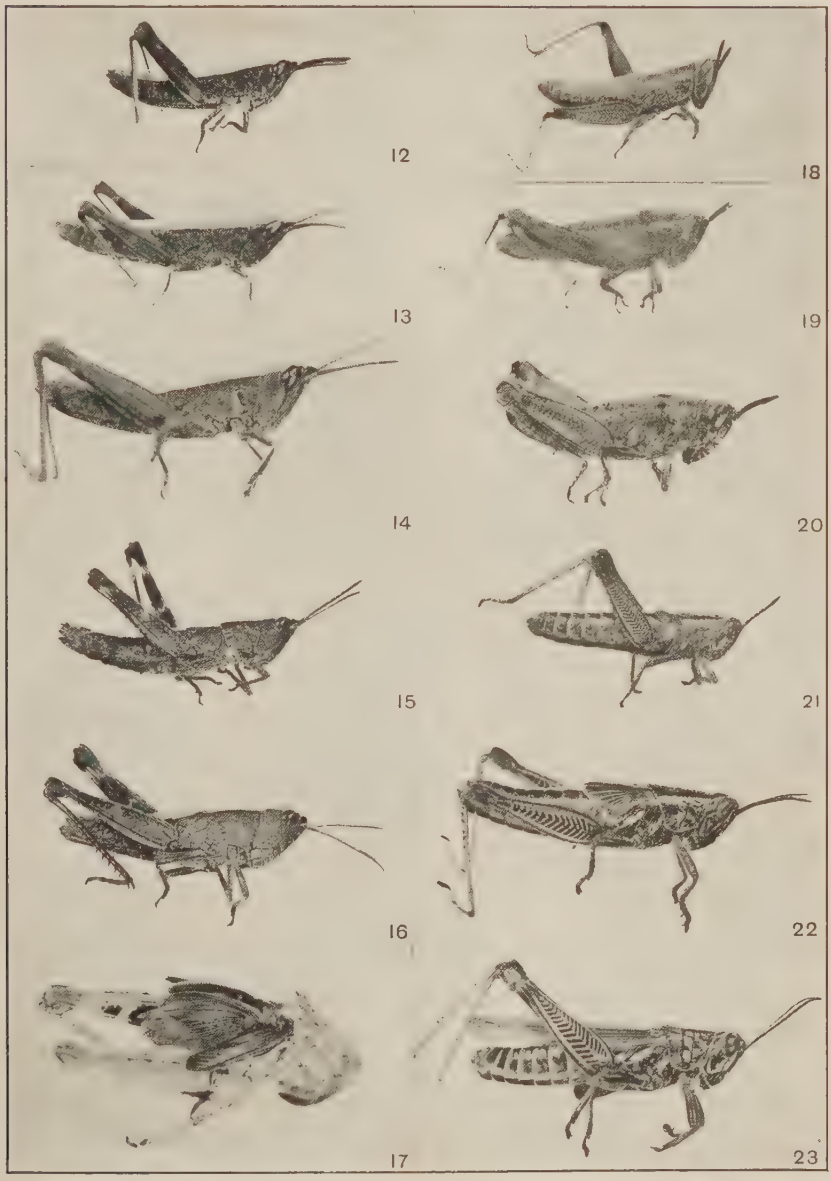


CAROTHERS—NOTES ON CERTAIN ACRIDIDAE (ORTHOPTERA)

CAROTHERS—NOTES OF CERTAIN ACRIDIDAE (ORTHOPTERA)

A TABULAR ACCOUNT OF THE STRUCTURAL DIFFERENCES BETWEEN THE FOUR LARVAL INSTARS OF CULEX PIPIENS

BY EUGENE M. LANDIS

Summary

The present paper aims to show that in addition to variation due directly to growth, the four larval instars of *Culex pipiens* vary in certain characters also with respect to degeneration, change, and disappearance of parts. In view of the similarities, noted below, which exist between the larvae of *C. pipiens* and *C. restuans* during their first instar, it is possible that future work along this line may bring to light interesting facts concerning species which are very easily differentiated as larvae in the fourth instar.

The contrast has also made it clear that no classification of larvae can be safely made unless it is positively known that they are in the fourth instar, since the successive instars differ markedly in most of the fundamental characters used in both keys and descriptions.

Material

The single egg raft from which all the individuals developed was collected late in April, 1922, in a stagnant pool just outside the limits of West Philadelphia. The young larvae after their emergence were, in some cases, isolated and placed in individual containers and examined daily for larval casts. These were then mounted in Farrant's Medium (an aqueous gum arabic and glycerine solution). This procedure provided series showing all the chief characteristics of the four instars, leaving no doubt as to their identity.

The remaining larvae were kept in a large culture dish and, from time to time, were examined in the living, and fresh-killed, condition. Whole individuals in each stage were mounted in balsam and in Farrant's Medium, after being killed by immersion in hot Bouin's Fluid. This killing medium causes a minimum

amount of contraction and is especially well suited for this purpose, particularly if the larvae remain in the solution for two or three minutes. It is very difficult to remove the solution if it has completely penetrated the larvae.

Purpose of the Work

The aim of these observations was (1) to ascertain just what changes went on during larval growth and (2) to find whether any changes might take place which could not be explained by mere growth, i.e. the partial degeneration, disappearance or migration of certain structures.

It was soon quite evident that there are surprising differences in the numbers and size of hairs. But more interesting are those changes not to be explained on the ground of mere growth. The antennal plume during the first instar is found at the middle of each antenna, whereas in all other instars it is found at the junction of the middle and distal thirds of the antenna. Likewise the scales of the eighth segment are more numerous and differently arranged during the second instar. In this connection it is interesting to note that *Culex restuans* and *C. pipiens* cannot be easily differentiated during the first instar. In the second they are quite different, however, since the two characters noted above, while changing in the case of *Culex pipiens*, remain unchanged in *C. restuans*. Moreover, hairs degenerate, disappearing suddenly for a single instar (Second Period, Point 19, no. 4), or gradually degenerating (Point 18, no. 4). In the latter case the hairs become smaller and the tuft simpler instead of more complex. Some hairs also change progressively, while others remain unchanged throughout the four larval instars (Points 10, 23, and 25).

The only other paper known to the writer which in any definite manner considers these differences is that of H. Stadtmann Auerfeld (1921).[1] Only twelve characters are compared, of which four deal with dimensions. The present paper considers over thirty structural characters, exclusive of dimensions. The range of variation determined in the two cases differs with respect

[1] "Übersicht über die Morphologie der 4 Larvenstadien einiger Culiciden," Mitt. Zool. Inst. Westf. Wilhelms Univ., Munster i. W., no. 3, pp. 42–43.

to certain structures. Whenever this occurs the numbers recorded by H. Stadtmann-Auerfeld are given in a foot-note.[2]

The writer wishes to acknowledge his indebtedness to Professor P. P. Calvert and to express his gratitude for helpful criticism and many valuable suggestions.

Outline of Contrasting Characters

POINTS OF CONTRAST	Number in the Tables
I. *Head*	
(a) Egg burster	1
(b) Eyes	2
(c) Antennae	
1. Shape	3
2. Diameter	4
3. Color	5
4. Spiny covering	6
5. Antennal plume	
a. Position	7
b. Number of hairs	8
6. Terminal appendages	9
(d) Hairs of the head	
1. Dorsal surface	
a. Anterior portion	10
b. Posterior portion	11
2. Lateral surfaces	
a. Antennal tuft	12
b. Subocular tuft	13
3. Ventral surface	
a. Around the eye	14
b. Labial hairs	15

[2] Another more recent paper has been found, which compares certain of the characters mentioned here:

Ernst Tänzer, "Morphogenetische Untersuchungen und Beobachtungen an Culiciden-Larven. 1 Teil, Morphogenetische Beobachtungen." Archiv für Naturgeschichte, Heft 7, 1921, p. 136. This paper contains references to characters here numbered 2, 7, 8, 10, 12, 27–30, 33 and 34. Text figures represent the entire animal in each of the four instars, dorsal view of the head (second and third instars), the caudal extremity (third) and details of pecten for all four instars.

(e) Mouthparts — Number in the tables

1. Labium
   - a. Shape 16
   - b. Number of teeth 17
2. Mandibles } These are not considered.
3. Maxillae }

II. *Thoracic Hairs*

- (a) Anterior border 18
- (b) Middle of thorax 19
- (c) Posterior portion 20

III. *Abdomen*

- (a) The First Seven Segments
  1. Subdorsal hairs 21
  2. Lateral hairs 22
- (b) The Eighth Segment
  1. Hairs
     - a. At the base of the siphon 23
     - b. Between siphon and anal segment .. 24
     - c. Anterior to anal segment 25
  2. Scales
     - a. Arrangement 26
     - b. Number 27
  3. The Siphon .
     - a. Hairs 28
     - b. Pecten
       - i. Number of spines 29
       - ii. Number of teeth on each spine . 30
     - c. Extent of chitin 31
- (c) The Anal Segment
  1. The Saddle—chitinization 32
  2. Dorsal tuft 33
  3. Barred area and its tufts 34

IV. *Dimensions* (Measurements made at the beginning of each instar)

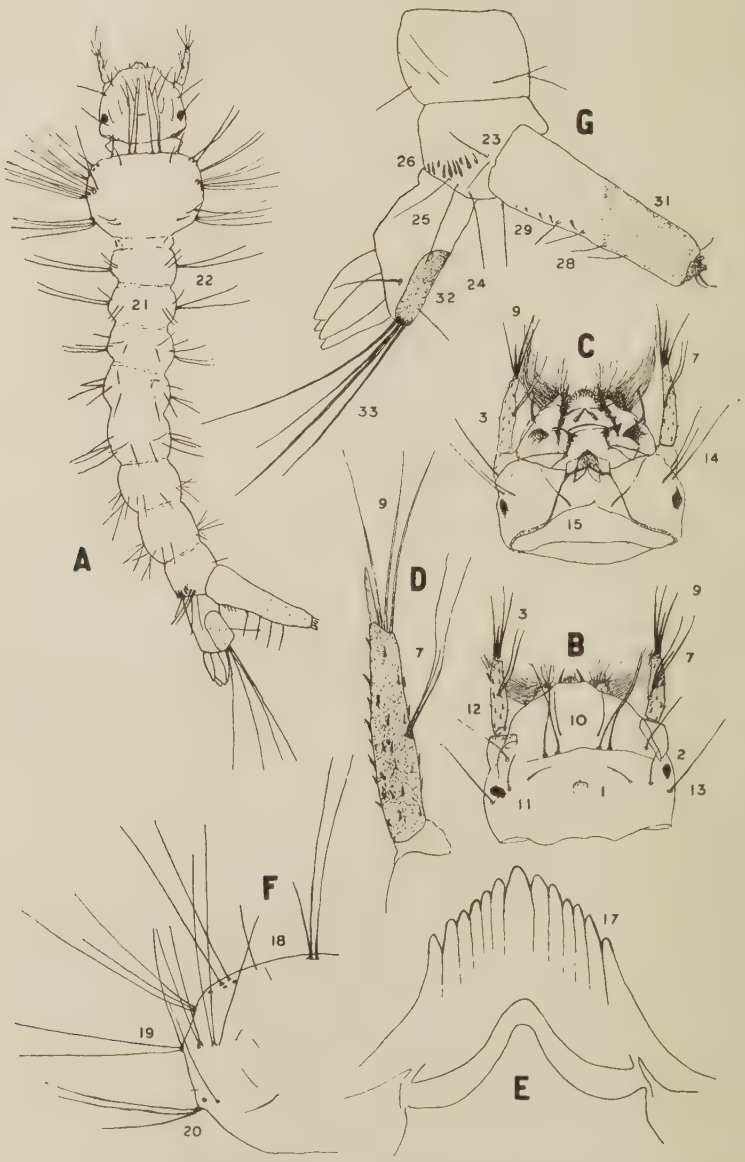
- (a) Total length 35
- (b) Breadth of the head 36
- (c) Breadth of the thorax 37
- (d) Length of the siphon 38

Numbers corresponding to the above-listed "Numbers in the Tables" have been placed on the figures of Text-plates I to IV, for ease of reference.

First Instar (Text-plate I)

1. Egg burster present.
2. Single pair of simple eyes, very small, reddish, and regular in outline.
3. Antennae cylindrical, straight or very slightly curved, the bend being near the base.
4. Antennae almost uniform in diameter throughout, the distal extremity being three-quarters of the width of the widest part.
5. Antennae pale, with little chitin, color uniform throughout.
6. Antennae with relatively few spines.
7. Antennal plume placed midway between the base and apex.
8. Antennal plume consisting of two, rarely three, hairs, the third always being shorter;[3] the hairs themselves are long, thin, pliable.
9. Terminal appendages of the antennae include one short stout spine, three long bristles, all mounted on a flat tip, or with two bristles slightly depressed.
10. Hairs on the anterior portion of the dorsal side of the head consist of three pairs, all of the same diameter, the anterior pair being slightly shorter than the two posterior and lateral pairs.
11. On the posterior portion of the dorsal surface two pairs of simple, thin, long hairs.
12. Antennal tuft on the lateral surface of the head is represented by a single very thin hair.
13. Subocular tuft is a single, very long, thin hair.
14. On ventral surface of the head,—three pairs of single hairs, posterior to base of the antennae, ventral and anterior to the eye.
15. On the labial plate, —a single pair of very long, thin, simple hairs.
16. Labium not distinctly five-sided, but rather roughly triangular with bulging sides.
17. The labial teeth usually number thirteen, consisting of a large, central tooth and six lateral, the most external one being usually small and depressed. Eight or nine lateral teeth may occur.

[3] Two to four.



Text-plate I. First Larval Instar of *Culex pipiens*. A.—Dorsal view of entire larva. B.—Dorsal view of head. C.—Ventral view of head. D.—Antenna. E.—Labium. F.—Dorsal view of thorax. G.—Lateral view of caudal extremity.

18. Along the anterior border of the thorax the following hairs are found beginning with the most median:
    1. A single long hair and a tuft of two hairs mounted in slightly fused basal chitinous plates.
    2. A simple short hair posterior to which is another still shorter.
    3. Two simple long bristles arising from partially fused basal plates.
    4. More ventral and slightly posterior is a three to four-haired tuft from a single conical basal plate.
    5. On the ventral surface where the neck joins the thorax is found a pair of short simple hairs.
19. At the middle of the thorax, beginning at the mid dorsal line are found the following:
    1. Frequently in the subdorsal area two very thin simple hairs.
    2. A simple hair of medium size.
    3. A tuft of two hairs, one long and one short.
    4. A tuft of two hairs, both long.
    5. A tuft of three or more hairs, all long.
20. Along the posterior border of the thorax are usually found the following hairs, beginning with the most median on the dorsal side.
    1. Two short, fine, simple hairs.
    2. A fairly large, simple hair.
    3: A tuft of three hairs, one slightly smaller than the others.
21. Sub-dorsal hairs of the first seven segments of the abdomen are all simple, relatively few, thin, and very long.
22. Lateral tufts consist usually of two hairs on the first two, sometimes three, segments, otherwise they are simple.
23. On the eighth segment at the base of the siphon are two hairs, both simple.
24. On the eighth segment between the base of the anal siphon and the anal segment is a simple long hair.
25. On the eighth segment anterior to the anal segment are two simple hairs, a dorsal and a ventral one.
26. The scales of the eighth segment are arranged roughly in a single, irregular row.[4]

[4] Two rows. This difference is due merely to a different designation of the arrangement of spines. The term "single irregular row" describes the condition better since there are not two definite linear rows. This applies to the same character in other stages as well.

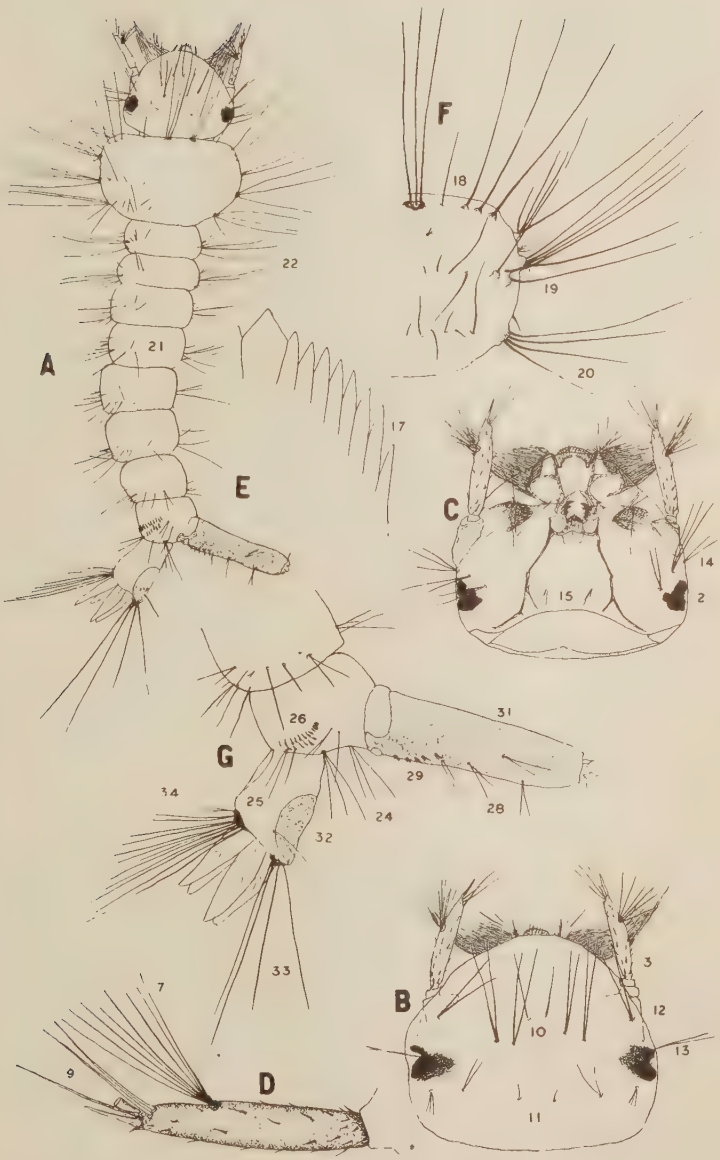
27. The scales number nine to eleven with an average of ten.
28. Siphonal hairs are four on each side, and simple.
29. There are from four to six spines on the pecten.
30. Spines are one-to three-pointed.
31. The anal siphon is chitinized for one-half its length, the proximal half is still membranous.
32. The saddle of the anal segment consists of a dorsal plate only, since chitinization has only begun.
33. The dorsal tuft of the anal segment consists of four hairs, of which two are long and two short.
34. Barred area of the anal segment, with its tufts, entirely lacking.
35. Average total length is 1.3 mm.[5]
36. Breadth of head—.32 mm.
37. Breadth of thorax—.33 mm.
38. Length of the siphon—.34 mm.

Second Instar (Text-plate II)

1. Egg burster absent.
2. Eye is composed of one simple element and anteriorly a small compound element, general outline is irregular.
3. Antennae somewhat curved inwardly, the curve, being in general equal throughout.
4. Antennae are not uniform in diameter, but thinner in the apical third. The distal extremity is but one-half as wide as the proximal portion.
5. Antennae more heavily chitinized, and darker in color at the distal extremity.
6. Number of spines on the antennae increased.
7. Antennal plume situated at the junction of the middle and distal thirds of the antenna.
8. Antennal plume consists of six to eight hairs, relatively shorter, stouter, and less pliable.[6]
9. Terminal appendages of antennae include a short stout spine, three long bristles, and a cylindrical digit, chitinized but without sensory cone. Two bristles usually moved slightly proximad in the depression.

[5] The measurements recorded here were all made shortly after the larvae emerged from the larval cast of the preceding period. The dimensions are hardly comparable to those of Stadtmann-Auerfeld, which presumably are the averages during the entire period. The present dimensions are, as might be expected, slightly smaller than those recorded in the paper referred to.

[6] Ten to twelve.



Text-plate II. Second Larval Instar of *Culex pipiens*. A.—Dorsal view of entire larva. B.—Dorsal view of head. C.—Ventral view of head. D.—Antenna. E.—Labium. F.—Dorsal view of thorax. G.—Lateral view of caudal extremity.

10. Frontal hairs consist of two posterior pairs of two-branched hairs, and an anterior pair of small simple hairs.
11. On posterior portion of the head, the median pair of hairs usually simple; the lateral pair two-branched.
12. Antennal tuft a two- or, rarely, a three-branched hair.[7]
13. Subocular tuft is double, very long and thin.
14. On ventral surface of the head the median pair of hairs is two-branched, the lateral pairs two- or three-branched.
15. On the labial plate there is a single pair of simple hairs, or two- or three-branched hairs, much shorter in length.
16. Labium more distinctly five-sided, but varies considerably.
17. Labium has one large central tooth and eight lateral, the last one being usually small and undeveloped.
18. Along the anterior border of the thorax the following hairs are found beginning with those nearest the mid dorsal line.
    1. A tuft of three distinct hairs supported in separate pits in the same basal plate.
    2. A single hair, fairly long, and posterior to it a small tuft with four to five branches.
    3. Three large single hairs in a row.
    4. A tuft of four hairs, mounted on a conical base, including one long hair, two medium and one very short.
    5. A single hair on each side of the neck on the ventral side.
19. At the middle of the thorax beginning at the mid dorsal line are found the following:
    1. Two short, simple, and laterally two long simple, hairs, all very thin and pliable.
    2. One single hair of large size.
    3. Two hairs from the same basal plate.
    4. Missing.
    5. Tuft of four large hairs.
20. In the posterior region of the thorax beginning in the mid dorsal line are found the following hairs:
    1. Two short single, then a two-branched or simple hair, followed by two more short simple hairs.
    2. One long pliable simple hair.
    3. A tuft of four long hairs. Frequently one of these is very short.
21. Sub-dorsal hairs of the first seven segments of the abdomen are in many cases two-branched, or even three-branched, and much more numerous.

[7] Three.

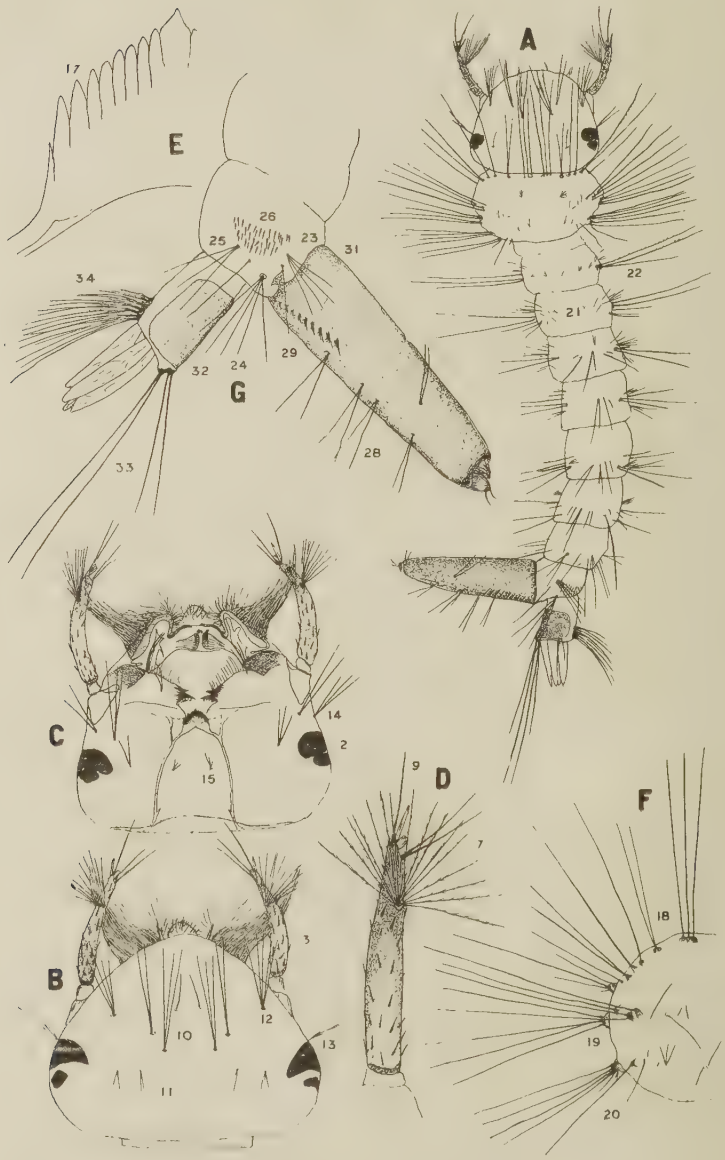
22. The lateral hairs consist of two-haired tufts and sometimes three-haired ones in the first three segments.
23. On the eighth segment at the base of the siphon the posterior hair is simple, the anterior hair, two- or three-branched.
24. Fan-shaped plume between the base of the anal siphon and the anal segment is three- or four-branched and already shows feathery projections.[8]
25. Anterior to the anal segment the dorsal hair is simple, the ventral one, two-branched.
26. The scales of the eighth abdominal segment are arranged irregularly in a double row.[9]
27. The scales vary in number from eighteen to twenty-two.
28. The hairs of the anal siphon are four in number and two-branched. There may also be one or two extra ones, dorsally located, and usually simple.
29. Pecten carries from four to six spines.
30. These spines are from one to three pointed.
31. The anal siphon is about seven-eighths chitinized.
32. The saddle of the anal segment extends one-third of the way down the side of the segment.
33. The dorsal tuft consists of four hairs.
34. The barred area contains five well formed bars bearing each a two-branched hair. One to three smaller bars anteriorly may bear a short spine.
35. Total length—2.6 mm.
36. Breadth of the head—.53 mm.
37. Breadth of the thorax—.54 mm.
38. Length of siphon—.62 mm.

Third Instar (Text-plate III)

1. Egg burster absent.
2. Eye consists of a single simple eye and anteriorly a crescent-shaped compound eye.
3. Antennae are more curved inwardly.
4. Antennae are not uniform in diameter, smaller in the distal third. The distal extremity is one-half as wide as the proximal.
5. Antennae more heavily chitinized and somewhat darker distally.

[8] Three branched.

[9] Three rows.



Text-plate III. Third Larval Instar of *Culex pipiens*. A.—Dorsal view of entire larva. B.—Dorsal view of head. C.—Ventral view of head. D.—Antenna. E.—Labium. F.—Dorsal view of thorax. G.—Lateral view of caudal extremity.

6. Spines are quite numerous.
7. Antennal plume is situated at the junction of the middle and distal thirds of the antenna.
8. The plume consists of from eleven to sixteen hairs usually, although in some cases even wider variation occurs.[10]
9. Terminal appendages are as in the second instar, except that the cylindrical digit is now also supplied with the pale membranous sensory cone. The two bristles have become more definitely moved into the recess.
10. The hairs of the frontal region of the head are composed of a hind three-branched, a middle two-branched (rarely three) and a fore simple, small pair of hairs.
11. The median pair of the posterior surface of the head is two- to three-branched while the lateral pair is three- to four-branched. Both are very small.
12. Antennal tuft is a four- to six-branched hair.
13. The tuft near the eye is two- or three-branched.
14. The three ventral tufts are all two- or three-branched.
15. The tuft of the labial plate is very short and comprises three or four branches.
16. Labium distinctly five-sided, though the angle for the sides varies considerably.
17. Usually one large central tooth, eight lateral with the beginning of the ninth at the side.
18. Along the anterior border of the thorax the following hairs are found, beginning with those nearest the mid dorsal line.
    1. A tuft of three arising from separate pits in the same basal plate.
    2. A two-branched hair posterior to which is a small many-branched tuft.
    3. Two single hairs, and laterally to these a two-branched hair, all long.
    4. Tuft of four, one very long, two short, and one very short.
    5. One simple hair, shorter, on each side of the neck near the thorax.
19. Along the middle of the thorax beginning at the mid dorsal line are found the following:
    1. Two short, simple, median, and two long, simple, lateral hairs all thin and pliable. This is the usual condition but variations may occur.
    2. One simple hair of large size.
    3. Two hairs from a single basal plate.

[10] Fourteen to eighteen.

4. Tuft of three hairs.
5. Tuft of three to five hairs of which one may be quite small.

20. In the posterior part of the thorax, beginning in the mid dorsal line are found the following hairs:
    1. Two median, short, simple.
       One tuft of three or more.
       Two very short, simple.
       One simple or two-branched hair of medium length.
    2. One long simple hair.
    3. One tuft of three to four long and one or two short hairs.
21. Sub-dorsal hairs of first seven segments of the abdomen two- to many-branched and very numerous.
22. Lateral hairs in tufts of two or three, and even four or five on first three segments.
23. At the base of the siphon the posterior hair is simple, the anterior is three- or four-branched.
24. The tuft between the anal siphon and anal segment is four- to six-branched and feathery.
25. Anterior to the anal segment the dorsal hair is simple, the ventral one three-branched.
26. The scales of the eighth abdominal segment are arranged roughly in a triangular patch.[11]
27. The scales number thirty-five to forty.
28. Hairs on the anal siphon are usually four on each side, commonly two-branched, though one or two basal may often be three-branched. An extra one or two simple hairs may also be found.
29. Pecten carries from six to eight large spines and one to three small ones.
30. Each spine of the pecten is one- to four-toothed.
31. The anal siphon is entirely chitinized.
32. The saddle of the anal segment extends one-half way down each side.
33. The dorsal tuft consists of four large hairs. The anterior pair may be branched to form two additional smaller hairs.
34. The barred area contains eight or nine well formed bars, bearing each a three- or four-branched hair, several of the anterior bars having double hairs, and finally a few bars with simple spines.
35. Average total length—3.6 mm.

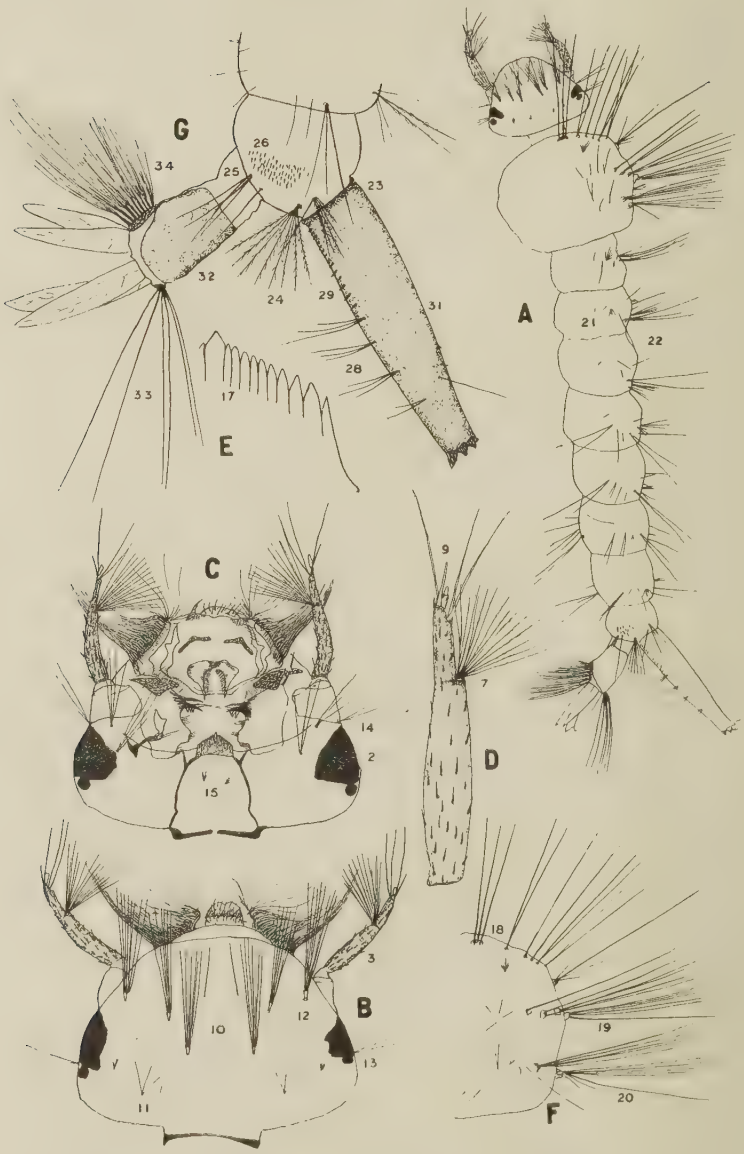
[11] Four to five rows.

36. Breadth of head—.75 mm.
37. Breadth of thorax—.74 mm.
38. Length of siphon—.98 mm.

Fourth Instar (Text-plate IV)

1. Egg burster absent.
2. Eye consists of a single, simple eye lodged in the hollow of the crescentic, compound eye. The latter is very large and the simple eye may be attached to its posterior surface as a small lobe.
3. Antennae are very much curved inward, especially at the apex.
4. Outer third of the antenna is very much thinner than the basal portion. Diameter at apex only one-third that near the base.
5. Antennae heavily chitinized and darker distally.
6. Spines usually very numerous on the antennae.
7. Antennal plume is placed as in the third instar.
8. The antennal plume consists of from nineteen to twenty-two hairs, although in some rare cases even wider variation may exist.[12]
9. The terminal appendages are the same as those in the third instar. The two bristles are more distinctly moved toward the base.
10. The hind pair of dorsal head hairs is five- or six-branched, the middle pair is usually five- but may be six-branched. The fore hair is still single, comparatively small and thin.
11. On the posterior dorsal surface of the head there are two pairs of hairs, the median pair being three-branched, the lateral pair four-branched.
12. Antennal tuft is a seven- to ten-branched hair and plume-like, due to fine feathery branches.[13]
13. Tuft near the eye is usually single although it may be double.
14. The three ventral tufts are all three- or four-branched.
15. The tuft of the labial plate is very short, with three to five branches.
16. Labium distinctly five-sided, the angle at the anterior tip being appreciably greater. The labium is shorter and wider.

[12] Twenty to twenty-four.
[13] Eight to ten.



Text-plate IV. Fourth Larval Instar of *Culex pipiens*. A.—Dorsal view of entire larva. B.—Dorsal view of head. C.—Ventral view of head. D.—Antenna. E.—Labium. F.—Dorsal view of thorax. G.—Lateral view of caudal extremity.

17. One large central tooth, nine or ten well-developed lateral teeth, and a very small tooth at the side.
18. Along the anterior border of the thorax the following hairs are found, beginning with those nearest the mid dorsal line:
    1. A tuft of three hairs set in distinct pits in a common basal plate.
    2. A two-branched hair, back of which is a small tuft eight- to ten-branched.
    3. Two single and two two-branched hairs in a line.
    4. Tuft of three hairs, one medium size, two short on conical base.
    5. A single two-branched hair near the neck on the ventral surface. This may be entirely absent.
19. In the middle of the thorax beginning at the mid dorsal line are found the following:
    1. A rather variable group of sub-dorsal hairs including usually two short simple hairs, one long pliable simple hair, one long hair that may be simple or two-branched.
    2. One large simple hair.
    3. One tuft of two set in same basal plate.
    4. A tuft of five or six long hairs.
    5. A tuft of seven or more, one or two of which are quite small.
20. In the posterior part of the thorax, beginning at the mid dorsal line are found the following:
    1. A very variable group of small hairs, several in number, simple or branched.
    2. One simple hair of medium length.
    3. Tuft of five long hairs.
    4. Tuft of seven or more.
21. Sub-dorsal hairs of the first segments of the abdomen two- to many-branched, most with three or four.
22. Lateral hairs two- to five-branched in most cases. Tufts may in first two or three segments include six or seven hairs.
23. At the base of the siphon the posterior hair is simple, the anterior is four– or, more usually, five-branched.
24. Tuft between the anal siphon and anal segment is seven- or eight-branched and very feathery.
25. Anterior to the anal segment the dorsal hair is simple, the ventral one, four-branched.
26. The scales of the eighth abdominal segment are arranged in a triangular patch.[14]

[14] Five to six rows.

27. The scales number forty or more.
28. There are from four to six hairs on the anal siphon. There is a tendency for the basal hairs to be in tufts of three but the apical tuft consists usually of two hairs. The one or two extra hairs are more dorsally placed and simple.
29. The pecten carries from twelve to fifteen spines.[15]
30. Each spine is one- to five-toothed.
31. The anal siphon is entirely chitinized.
32. The saddle of the anal segment is entirely chitinized and encircles the segment.
33. The dorsal tuft of the anal segment consists of six hairs, one pair is double, each consisting of a long and a short hair, the other, posteriorly placed, is single and very long.
34. The barred area contains twelve to fourteen bars each supporting a five- or six-branched hair. Caudally they are longer, becoming shorter in front. The most anterior are two-branched or even simple spines.
35. Average total length—6.1 mm.
36. Breadth of head—1.1 mm.
37. Breadth of thorax—1.0 mm.
38. Length of siphon—1.6 mm.

[15] Eleven to thirteen.

NORTH AMERICAN ACRIDIDAE (ORTHOPTERA)

PAPER 3

BY JAMES A. G. REHN

A Study of the Ligurotettigi

Acridids which live in bushes, stridulate, and pick as their home-lands some of the most desolate areas in North America should stir the interest of almost any orthopterist. When to these qualifications we add remarkable and unusual modifications of structure, any enthusiastic "hopper" student would want to make an intimate acquaintance with the insects, particularly if he should be partial to eremian faunas. Of the very limited number of genera which would meet the requirements given above, two—*Ligurotettix* and *Goniatron*—have long interested my colleague, Mr. Morgan Hebard, and myself. We have been continually on the "qui vive" for them, and since our first field acquaintance with *Ligurotettix* in 1907, we have steadily accumulated material and information relating to these most interesting genera. In consequence I have at my disposal many times the amount of material ever previously assembled, and a great quantity of unpublished field observations.

The genera *Ligurotettix* and *Goniatron* form a generic group of the Acridinae (Truxalinae of authors), to which we here apply the name Ligurotettigi. The characters of this group are sufficiently distinctive to warrant this action, and such relationship as appears to exist is, on one hand with the phylum including *Ageneotettix*, *Aulocara*, *Eupnigodes*, *Psoloessa* and *Stirapleura*, and on the other hand with that including *Mecostethus*, *Pallasiella* and *Arcyptera*. The development of the marginal field of the male tegmina, which is directly connected with the stridulating powers of these insects, and of the process of the prosternum find nearest analogy in the Mecostethi, in which group both of these features are evident. The general form and fastigial features are more analogous to those found in the first phylum

mentioned above, which very properly might be referred to as the Stirapleuri.

The combination of features which may be considered distinctive of the Ligurotettigi are:

Fully alate. Form elongate. Fastigium not protuberant generally broad; scutellum moderately excavate; in profile fastigium is declivent to fastigio-facial angle, which is never pronounced. Antennae filiform. Eyes large, prominent, seen from dorsum subglobose. Pronotum subsellate, without lateral carinae; median carina low; caudal margin of disk obtuse-angulate to arcuate; lateral lobes deeper than long. Tegmina surpassing apex of abdomen, of male highly specialized by expansion of marginal field or entire tegmen suturad to ulnar vein; marginal field moderately or very greatly and distinctively expanded, fenestrate by disposition of transverse nervures; ulnar area not specialized by fenestration; discoidal vein on ventral surface greatly thickened and elevated. Prosternum with distinct but low process, subpyramidical or transverse tuberculate in form. Caudal tibiae with internal calcaria appreciably but not greatly unequal. Arolia relatively small. Ovipositor jaws simple.

The presence of a prosternal process in *Goniatron* bothered Bruner, who was for some time in doubt as to where he should place the genus,[1] although he finally decided it was truxaline. As a matter of fact *Mecostethus*, *Pallasiella* and *Arcyptera*, which it can hardly be questioned are truly truxaline, all show at least as distinct pyramidical prosternal productions as either genus of the Ligurotettigi.

Bruner particularly remarked the presence in *Goniatron* and *Ligurotettix* of a tooth on the proximal section of the internal margin of the caudal femora, which he evidently considered an unusual structure. This feature has no diagnostic value, as it is shared with many genera, not only truxaline but of other subfamilies.

The historical side of our information on *Ligurotettix* and *Goniatron* is treated under each of these genera. Scudder's assignment of *Ligurotettix* to the Epacromiae (Aiolopi of present day authors) has absolutely no warrant of fact, probably being due to the genus having so fitted in Brunner's key.[2] No

[1] Biol. Cent.-Amer., Orth., II, pp. 113–114, footnote, (1905).

[2] Ann. Mus. Civ. Stor. Nat. Genova, XXXIII, p. 123, (1893).

member of the group Aiolopi occurs in America, and the most cursory examination of the genera belonging to it and those comprising the Ligurotettigi will demonstrate the absence of any real relationship.

The group Ligurotettigi is apparently peculiar to the desert regions of the southwestern United States and northern Mexico. The specialization of the tegminal structure of the male is probably as great as, if not greater than, in any other acridid.

The series of the two genera before me number six hundred and twelve specimens, one hundred and fifty-one of *Goniatron* and four hundred and sixty-one of *Ligurotettix*. Of the series of the former genus but one specimen has been previously recorded, and all but eight were taken by Hebard and Rehn. Of the series of *Ligurotettix* ninety-two specimens have been previously recorded, and all but eight were taken by the same collectors.

The material here studied is, unless otherwise indicated, in the collection of the Academy of Natural Sciences of Philadelphia, and the Hebard Collection, which is deposited in that institution. Material previously recorded and contained in these collections is indicated by appropriate symbols or abbreviations, while previously unreported material collected by Hebard and Rehn is understood to be apportioned between the above series. Other institutions which have loaned material for this study have their series indicated by suitable abbreviations of the institution's name.

Key to the Genera

A. No marked dissimilarity in size in sexes. Form slender and appreciably compressed, Head narrow. Fastigium with weak cephalic indication of a median carina. Metazona of pronotal disk distinctly longer than prozona. Tegmina of more normal width, gradually narrowing distad from point of greatest width. Specialization of male tegmina as stridulating organs involving entire tegmina suturad to ulnar vein; development of marginal field less decided, with its areolae in large part divided longitudinally by the mediastine vein. Marginal field of male tegmina evenly narrowing distad. Caudal femora more slender, file of internal surface with coarser, fewer teeth.
Goniatron Bruner

AA. Males very distinctly smaller than females. Form slender but little compressed. Head broader. Fastigium with no indication of median carina cephalad. Metazona of pronotal disk but little longer than prozona. Tegmina narrow, of male markedly narrowed at apex of marginal field. Specialization of male tegmina as stridulating organs almost entirely confined to marginal field, which is greatly expanded and with its areolae undivided. Marginal field of male tegmina terminating quite abruptly. Caudal femora more robust, file of internal surface with finer, more numerous teeth.....*Ligurotettix* McNeill

GONIATRON Bruner

1905. *Goniatron* Bruner, Biol. Centr.-Amer., Orth., II, p. 112.

Genotype.—*G. planum* Bruner. Type by monotypy.

Generic Description.—Sexes similar in general form and size, former appreciably compressed. Fastigium broad, with length and breadth subequal; median carina on same weakly indicated cephalad. Pronotum with metazona distinctly longer than prozona; caudal margin of dorsum of pronotum rounded obtuse-angulate. Tegmina of moderate width, in male gradually narrowing distad from point of greatest width; specialization of male tegmina as stridulating organs involving entire tegmen suturad to ulnar vein; marginal field of male moderately expanded but regularly narrowing distad in its distal half, its areolae in large part divided into two by mediastine vein; humeral trunk regularly arcuate in male; ulnar area of male tegmina multi-areolate. Prosternal process low but pyramidal in form. Caudal femora with teeth of file of internal surface well spaced and relatively large.

The features of difference from the genus *Ligurotettix* are clearly set forth in the above key. No difficulty should be experienced in the separation of the two genera.

The genus *Goniatron* as far as known at this writing contains but a single species. The distribution of the genus and the chief variational features are discussed under *Goniatron planum*, the sole included species.

The history of the genus as a unit of systematic entomology is completely presented by Bruner's original description of the genus and species. Nothing has been published prior to the present day on the habits of the genus, and no material has been recorded by other authors except the original type.

Goniatron planum Bruner (Pl. VI, figs. 1–4.)

1905. *Goniatron planum* Bruner, Biol. Centr.-Amer., Orth., II, p. 113, pl. I, figs. 20, 20a and 20b. [♂ (incorrectly marked as ♀ on plate); Comacho, (error for Camacho), Zacatecas, Mexico.]

Type.—♂; Camacho, Zacatecas, Mexico. November. 1887. (Lawrence Bruner.) [Hebard Collection, Type no. 268.]

The type is a dry preparation with left tegmen and wing spread. The right antenna is missing and the apices of the tegmina and wings have been considerably damaged.

Morphological Features.[3]— Size medium. Surface dull. Head short, transverse when seen from dorsum, relatively deep when seen in cephalic aspect: fastigium appreciably excavated, caudo-lateral sections of bounding carinae subparallel; interspace between eyes broad, subequal to fastigial length; in profile fastigium is appreciably declivent, facio-fastigial angle rounded obtuse, moderately prominent, facial line moderately retreating: frontal costa very broad, between antennal bases subequal to fastigium in width, markedly narrowing dorsad to but one-half that width where it joins the fastigium, weakly narrowing ventrad of median ocellus to about three-fourths of greatest width and thence subparallel to clypeal suture, lateral margins of costa sharply defined dorsad, broadly rounded and much less decided ventrad; surface of frontal costa very shallowly excavate and impresso-punctate in broadest section and for some distance ventrad of median ocellus; lateral facial carinae marked, moderately arcuate diverging ventrad. Eyes prominent, particularly in male sex, in basal outline ovate, slightly deeper than length of infra-ocular sulcus. Antennae two-thirds again as long as the head and pronotum combined.

Pronotum relatively short, moderately selliform, weakly substrangulate, transverse sulci distinct but not deep, all severing median carina; median carina marked but rather low; cephalic margin of disk weakly arcuate; lateral lobes subrectangulate, faintly deeper than long; caudal margin of lobes straight; ventral margin oblique subtruncate in cephalic half; ventro-caudal angle narrowly rounded rectangulate.

Tegmina surpassing apices of caudal femora by at least twice length of pronotum, point of greatest width mesad, this contained four and one-third (♂) to five and one-third (♀) times in greatest tegminal length: costal margin of tegmina in male as a whole broadly arcuate, in female more flattened mesad, proximal lobe so greatly reduced as to be subobsolete;

[3] Drawn chiefly from the following: ♂, ♀; Sanderson, Texas. August 25, 1912. (R. & H.) ♂; Sierra Blanca, Texas. September 13 to 14, 1912. (R. & H.)

sutural margin nearly straight: mediastine vein strongly developed, reaching costal margin at point of greatest tegminal width; areolation of marginal field made up of numerous narrow transversely disposed areolets, chiefly on humeral side of mediastine vein, in female much less decided than in male; humeral vein in male thickened and elevated on ventral surface of tegmina in proximal half of same, greatest thickening in distal portion of inflated section of vein, in female this vein is hardly inflated or elevated; intercalary and ulnar areas to shortly distad of median forks with numerous transverse nervures forming narrow areolets, these much more pronounced in the male than in the female; ulnar area irregularly biseriate areolate. Wings with apices moderately sharp, greatest width contained twice in greatest length of same.

Abdomen of male with dorsal surface subdeplanate, mediolongitudinally carinate, lateral borders of dorsum rounded, this condition much less evident in female. Cerci of male simple, short, not longer than two-fifths of supra-anal plate, tapering, acutely conic. Subgenital plate very short, bluntly conical produced. Caudal femora with greatest length contained about three and three-fourths times in greatest length of same.

Morphological Notes.—In describing the genus *Goniatron*, Bruner gave as a diagnostic character the following: "The abdomen differs from that of all other known forms in having the dorsal portion on each side of the centre flattened, these fields being separated from the sides by well-marked angles or ridges, the abdomen thus appearing tricarinate . . . ." The condition described by the original author is clearly observable, but it is by no means as decided as his words would indicate, and it is also found in *Ligurotettix*. Thus it is not peculiar to *Goniatron*, but is a group feature, at best not as striking as the original remarks would suggest, and more evident and exaggerated in the type than in other, much fresher, material. In no case could the abdomen correctly be referred to as even "appearing" tricarinate.

The original author gave the number of spines on the external margin of the caudal tibiae (eleven to twelve) as a diagnostic feature of the genus, as opposed to ten present in *Ligurotettix*. An analysis of twenty-six individuals, evenly divided between the sexes and selected at random from most of the series, shows the number of these spines varies from nine to thirteen, also

that no geographic correlation in the number present is indicated. The details are as follows:

	Right tibia	Left tibia
♂, Carlsbad, New Mexico	10	9
♂, Carlsbad, New Mexico	11	10
♀, Carlsbad, New Mexico	12	13
♀, Carlsbad, New Mexico	12	13
♀, Lordsburg, New Mexico	11	10
♂, Kent, Texas	10	9
♂, Kent, Texas	11	11
♀, Kent, Texas	11	11
♀, Kent, Texas	11	11
♂, Marathon, Texas	12	11
♂, Marathon, Texas	11	11
♀, Marathon, Texas	11	12
♀, Marathon, Texas	12	13
♂, Sierra Blanca, Texas	12	11
♂, Sierra Blanca, Texas	11	11
♀, Sierra Blanca, Texas	12	11
♀, Sierra Blanca, Texas	12	13
♂, Sanderson, Texas	10	10
♂, Sanderson, Texas	11	11
♀, Sanderson, Texas	12	13
♀, Sanderson, Texas	11	11
♂, Camacho, Zacatecas (*type*)	11	12
♂, Monclova, Coahuila	11	10
♂, Monclova, Coahuila	11	11
♀, Monclova, Coahuila	12	12
♀, Monclova, Coahuila	12	—

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
Playas Valley, New Mexico	23.9	4.5	3.6	22.5	11.2
Carlsbad, New Mexico	21.5	4	3.4	21.2	10.3
Carlsbad, New Mexico	22.8	4.6	3.9	22.4	11.9
Phantom Lake, Texas	24	4.5	3.6	22.7	11.5
Kent, Texas	20.2	3.7	3.1	21.4	10.4
Sierra Blanca, Texas	20.3	4	3.5	20.6	10
Sierra Blanca, Texas	23	4.4	3.8	23	12
Marathon, Texas	20.8	4	3.3	19.4	10
Marathon, Texas	22.5	4.4	3.9	23	11.7
Sanderson, Texas	18.2	3.5	3	19.2	10
Sanderson, Texas	22.2	4.2	3.8	23	11.7

♂	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
Double Windmill, Texas ..	20	3.6	3.5	20	10
Double Windmill, Texas ..	22.3	4.2	3.4	22.1	11.5
Persimmon Gap, Texas....	19.4	3.5	3.4	20.5	10
Persimmon Gap, Texas ...	24.2	4.8	3.9	23.7	12.6
Monclova, Coahuila.....	23.5	4.6	3.7	23.4	11.7
Monclova, Coahuila.....	26.5	5.4	4.1	26.2	13.5
Camacho, Zacatecas, *type* .	23.7	4.6	4	23[4]	12
♀					
Lordsburg, New Mexico ..	26.7	4.5	3.8	23.2	11.7
Carlsbad, New Mexico....	26.5	4.5	4	22.8	12
Carlsbad, New Mexico....	26.8	4.7	3.8	25	12.1
Kent, Texas.....	24.5	4.4	4	22.8	11
Sierra Blanca, Texas	23.2	4.2	3.7	22.2	10.8
Marathon, Texas	22.5	4	3.6	21.4	10.2
Marathon, Texas	25	4.4	4.2	24	11.8
Sanderson, Texas	22.8	4.2	3.6	23.5	11.2
Sanderson, Texas	20.5	4	3.5	21	10
Double Windmill, Texas ..	22.5	4.1	3.5	21	10.3
Persimmon Gap, Texas ...	22.5	4.2	3.4	22	10.5
Between Dry Tank and Mailbox Tank, Texas ...	27[5]	4.2	3.5	22.2	10.7
Between Dry Tank and Mailbox Tank, Texas...	27.9	4.5	4.3	24.2	12.5
Monclova, Coahuila.....	26.2	5	4.1	25.7	12.5

It is quite evident that very great individual variation in size is present in both sexes, and that this tendency is found throughout the range of the species.

An analysis of the above figures shows that the specimens from Monclova average very large, followed in this by the type from Camacho. Of the specimens from the United States those from the Pecos Valley at Carlsbad, and the Playas Valley, New Mexico, as well as others from the Santiago Range, western Texas, at Persimmon Gap, average large, with material from Sierra Blanca and Marathon, Texas, above the average size of the whole series. The single Lordsburg female is relatively

[4] As the apices of the tegmina are damaged, we are unable to take our own measurement. Bruner gives 23 mm. as their length, which measurement was probably made before the type suffered any damage.

[5] Abdomen abnormally extended.

large, which, with the dimensions of the Playas Valley and Carlsbad specimens would seem to indicate that *Goniatron planum* does not regularly decrease in size toward the northern border of its range. At the same time the individual size variation in any series is so marked that it is difficult to determine true geographic tendencies in measurements.

Color Notes.—The general impression received from this insect is of a dull brown coloration, often tending toward grayish brown, either with weak traces of darker punctulations or with this tendency pronounced, and developed, particularly on the tegmina, into a marked "pepper and salt" pattern, the pale elements of which are often paler than the general tone. The base brown color ranges from tawny and snuff brown to as dark as mars brown and mummy brown, the dark punctulations, which are subquadrate in shape, frequently blackish brown, while the pale ones are as light as dull ochraceous-buff to cinnamon-buff. Occasional individuals are dully suffused with a wash of liver brown, while others, which are virtually without punctulations, have the proximal half of the ulnar and anal fields of the tegmina of the paler color mentioned above. The face is, to a variable degree, transversely bifasciate with dark brown, this frequently restricted to the frontal costa, and generally contrasted with the frequently light ochraceous-buff pale section between; the genae are occasionally of the same pale color. Eyes clay color to tawny, mottled with blackish brown. Antennae dull rufous to kaiser brown, in darker individuals obscurely annulate with the two shades. Lateral lobes of pronotum never solidly infumate, as frequent in *Liguro-tettix*. Wings with proximal half reed yellow of varying depth; distal half of wing infumate with clove brown, more weakly so in anterior field, this blending into the yellow disk and on distal section of radiate field developing an areolate tendency in its intensity; veins of infumate section lined with clove brown, those near costal margin carrying this tendency more pronouncedly toward the base of the wing. Caudal femora generally clove brown to blackish fuscous quadrifasciate, one bar markedly proximal, author on the genicular extremity, the others spaced between, all bars obsolete, subobsolete or less distinctly marked

on external face than on dorsal surface, well indicated on internal face, ventral surface of the general tone and unbarred. Caudal tibiae of the paler base color, blotched with fuscous to variable degrees; spines ochraceous-buff, black tipped.

The color ranges do not seem to be clearly interpretable as intensification or recession of the same basis pattern, but rather the result of stresses of more than one tendency or factor, as we know from genetic evidence occurs in other acridids, as the grouse-locusts. The base tone seems to be entirely independent of the factor for punctulation, which occurs uncorrelated with either pale or dark base color. The latter factor also does not appear to be markedly controlled by locality, as from Sierra Blanca and Sanderson, Texas, and Monclova, Coahuila, we have strongly punctulate and subobsoletely punctulate individuals in the same series. The factors for marked barring of the caudal femora or for facial barring do not appear to be correlated with that for tegminal punctulation.

Geographically the general color tone of the individuals appears, to some extent, to show correlation. The palest individuals are from localities in low, very arid and hot sections of extreme western Texas, as Double Windmill, near Bone Spring, Persimmon Gap and Phantom Lake, while the relatively large series from Sanderson, Marathon and Sierra Blanca show only an occasional one approaching in paleness the other lots. On the other hand the relatively small series from between Dry Tank and Mailbox Tank, Texas and Monclova, Coahuila show marked variety in basal tone.

Distribution.—The range of this species (see text-figure 1) extends from the lower Pecos Valley of New Mexico (Carlsbad) and southwestern New Mexico (Playas Valley and Lordsburg), south to eastern Coahuila, (Monclova) and northern Zacatecas (Camacho), east as far as Sanderson, Texas and Monclova, Coahuila, west to Lordsburg, New Mexico. As far as known the species does not occur west of the Continental Divide, although at Lordsburg and Playas Valley it has been taken within a few miles of the watershed. In Texas it has not been taken east of the Pecos River, although considerable field work has been done by Hebard and Rehn in that territory. Likewise it was not noticed in the Pecos Valley at Roswell, New Mexico, or in the

El Paso region, which latter has been examined on a number of occasions by the same students. Its zonal correlation is entirely Lower Sonoran.

As we have stated under "Biological Notes" the species is virtually restricted in its distribution to areas of "black brush." However, it does not appear to be present wherever "black brush" grows. This plant is found in good stands at Naco, and

Text-figure 1.—Distribution of *Goniatron planum* in the United States and Mexico.

on the "bench" west of San Bernardino Ranch, Cochise County, Arizona, localities west of the Continental Divide and sixty to ninety miles to the westward of those given above. Careful search and regular listening at the proper time of day and in the right season failed, however, to indicate the presence of *Goniatron*, with which we were, at that time, well acquainted. It is quite possible that the species does occur in Arizona, but we have never seen it in that state, and its presence would, at any rate, very probably be in but a limited area in the extreme southeastern corner.

The vertical distribution in the United States would seem to be from as low as 2720 feet, near Bone Spring, Texas, and 2725 feet, at Double Windmill, Texas, to as high as 4650 to 4750 feet, at Etholen, Texas. In Mexico, *Goniatron* probably ranges to a much higher altitude, as Camacho is probably over 5000 feet elevation.

Biological Notes.—In habits this species is as essentially thamnophilous as the forms of the genus *Ligurotettix*. It is, however, even more partial to a single species of shrub, which is "black brush" (*Flourensia cernua*), a plant of local but fairly wide distribution in portions of that region called the "Eastern Desert Tract " by Mearns.[6] This plant affects the flats more than the hillslopes, and received its vernacular name from the blackish color of its twigs and bark. *Goniatron* like *Ligurotettix* is to be found on the main branches of the host bush, well protected from above by the straggly leaf cover of the plant, and from side view by a fair protective coloration and the shade of the cover. It is rather more sluggish and much easier to take than *Ligurotettix*, but when thoroughly disturbed it will fly out swiftly, usually alighting in another bush. Frequently, however, it will alight on the ground, from which it invariably springs into a nearby bush with astonishing speed. In some situations, as near Bone Spring, Texas, the black brush inhabited by *Goniatron* grew upon low basaltic hills, and at Sierra Blanca, Texas, the species was found on its host plant on hill-slopes of rock fragments. As a rule, however, the flats were the preferred habit of plant and guest, often wash land on the gentle slopes of a "draw". A typical habitat for the species is shown in plate VII, figure 7.

The stridulation of *Goniatron planum* is loud and rasping, a harsh krit-t-t-t-t, much louder, harsher and higher in pitch than that of *Bootettix*, much louder and more rasping than that of *Ligurotettix*. The sound is sufficiently loud to be heard by a person of normal hearing as far as fifty feet. Frequently all in a section would be stridulating, then suddenly all would cease and not a sound be heard for some time. The insect stridulates frequently on moonlit nights, but not as loudly as in the daytime. The maximum volume of sound is, of course, heard on warm sunny days.

[6] Mammals of the Mexican Boundary of the United States. Part I. Bull. 45, U. S. Nat. Mus., pp. 30–31, pl. II, (1907).

The species has been taken adult as early as June 20 (Phantom Lake, Texas), and as late as November 22 (Monclova, Coahuila), although we have seen no material from within the United States taken later than September 27. Doubtless the species occurs in the United States much later than this latter date, but probably is found as late as November only in the more southern part of its range. Immature individuals were taken at Sanderson, Texas, August 25, Marathon, Texas, September 12 to 13, Sierra Blanca, Texas, September 13 to 14, and Denton Well, Playas Valley, New Mexico, September 27, which would seem to indicate a seasonal life for the species, in western Texas and southern New Mexico, longer than evidenced by our adult material. The immature specimens from Marathon, Sierra Blanca and Denton Well are in the instar preceding maturity.

Specimens Examined: 151; 88 ♂, 55 ♀, 2 immature ♂, 6 immature ♀.

New Mexico: Lordsburg, Grant County, 4250–4600 feet, X, 15, 1910, (R. & H.; beaten from vegetation), 1 ♀. Denton Well, Playas Valley, opposite Hachita Grande Peak, Hidalgo County, 4200 feet, IX, 27, 1922, (H.; numerous in black brush on adobe flat), 2 ♂, 1 immat. ♀. Carlsbad, Eddy County, 3100 feet, VIII, 25, 1921, (R. & H.; moderately numerous on black brush), 4 ♂, 2 ♀.

Texas: Etholen, El Paso County, 4650–4750 feet, IX, 14, 1912, (Hebard; numerous in black brush), 1 ♂, 5 ♀. Sierra Blanca, El Paso County, 4524–4700 feet, IX, 13–14, 1912, (R. & H.; locally common in black brush), 9 ♂, 4 ♀, 1 immat. ♀. Kent, Culberson County, 3800–3900 feet, IX, 17–18, 1912, (R. & H.; common in black brush on flat), 4 ♂, 2 ♀. Phantom Lake, Davis Mountains, VI, 20, 1916, (F. M. Gaige), 2 ♂, [A. N. S. P., ex Zool. Museum, Univ. of Michigan]. Marathon, Brewster County, 3900–4160 feet, VIII, 26–27 and IX, 12–13, 1912, (R. & H.; common in black brush), 9 ♂, 10 ♀, 1 immat. ♂. Garden Spring, Brewster County, 3700 feet, IX, 2 and 11, 1912, (R. & H.; fairly common in black brush), 2 ♂. Hackberry Creek, Boquillas Road, Brewster County, 3159 feet, IX, 2, 1912, (R. & H.), 2 ♂. Double Windmill, Miravillas Creek, Boquillas Road, Brewster County, 2725 feet, IX, 3 and 10, 1912, (R. & H.), 5 ♂, 1 ♀. Persimmon Gap, Santiago Mountains, Brewster County, 2971 feet, IX, 3, 1912, (R. & H.), 2 ♂, 1 ♀. Two miles north of Bone Spring, Boquillas Road, Brewster County, 2720 feet, IX, 9, 1912, (R. & H.), 1 ♂, 1 ♀. Between Dry Tank and Mail Box Tank, Boquillas Road, Brewster County, about 3000 feet, IX, 4, 1912, (R. & H.; in black brush on barren wash), 2 ♂, 4 ♀. Sanderson, Terrell County, 2750–3180 feet, VIII, 25, 1912, (R. & H.; very common in black brush), 40 ♂, 22 ♀, 1 immature ♂, 4 immature ♀.

Coahuila: Monclova, XI, 22, 1909, (F. C. Bishopp), 2 ♂, 2 ♀, [U. S. N. M.].

Zacatecas: Camacho, XI, 1887, (Lawrence Bruner), 1 ♂, *type*, [Hebard Cln.].

LIGUROTETTIX McNeill

1897. *Ligurotettix* McNeill, Proc. Davenport Acad. Nat. Sci., VI, pp. 198, 257.

Genotype.—L. coquilletti McNeill. Type by monotypy.

Generic Description.—Sexes similar in general form, males of smaller size than females; form not appreciably compressed. Fastigium with no structural indication of median carina. Pronotum with metazona but little longer than prozona; caudal margin of dorsum of pronotum broad arcuate, with no true angulation. Tegmina narrow: in male sex markedly narrowed at apex of marginal field; specialization of male tegmen as stridulating organ almost entirely confined to marginal field, which is greatly dilated for one-half of tegminal length, terminating abruptly at three-fourths of tegminal length, at middle of tegmen equal to width of discoidal field at same point; transverse sectors of inflated section of marginal field regularly spaced and oblique, no longitudinal division of the areolae of this section of the field except by the abbreviate mediastine vein; intercalary and ulnar areas simple, not dilated or specialized: in female sex the tegmina are simple. Caudal femora with teeth of file of internal surface very numerous, fine and closely placed. Prosternal process very low, transverse, neither pyramidical or lamellate, but weakly more elevated cephalad.

We feel warranted in concluding that *Ligurotettix* is probably the more specialized of the two genera here treated. It is apparently a more vigorous stock, more capable of adapting itself to a variety of environments within its area of distribution, while its plasticity would argue decidedly in favor of considering it the younger of the two genera.

The genus *Liguroiettix* is at present known to contain but a single species, which, however, breaks into three geographic races or subspecies. Under the species, *Ligurotettix coquilletti*, the distribution of the genus is discussed.

Historically the genus has been discussed in the literature about seven times. The typical form of *Ligurotettix coquilletti* was described in 1897 by McNeill[7], on the basis of both sexes from Los Angeles County, California, collected by Coquillett. Nothing was then known of the habits of the genus, aside from Coquillett's comment upon the stridulation. In 1900, Scudder recorded[8] material of *coquilletti* from Yuma Arizona, and

[7] Vide supra.

[8] Psyche, IX, p. 95, (1900).

Palm Springs and Lancaster, California, taken by Prof. Morse. In 1903, Caudell[9] described a second form of the genus from southern Arizona (Phoenix) as *L. kunzei*, which we now know to be a geographic race of McNeill's species. In neither case were any data on the habits of the insects published. Rehn, in 1904, recorded material[10] as *kunzei* from Florence, Arizona. In the Biologia Centrali-Americana,[11] in 1905, Bruner reported *coquilletti* from Needles and Yuma, California, and quoted previous records of both *coquilletti* and *kunzei*. The extent of his information on the habits of the genus is that they "are known to live among and upon scattered desert vegetation," while he quotes Coquillett's observation on the stridulation as originally given by McNeill. In 1908, Rehn and Hebard published records[12] of *kunzei* from five localities in southern Arizona, giving information on size and color variation, as well as notes on the binomics of the insect. This was followed from the same authors in 1910 by a similar treatment of *L. coquilletti*[13], on the basis of material from six California and Nevada localities.

Ligurotettix coquilletti McNeill (Pl. VI, figs. 5-13.)

1897. *Ligurotettix coquilletti* McNeill, Proc. Davenport Acad. Nat. Sci., VI, p. 258, pl. V, figs. 24, 24a, 24b, 24c. [♂, ♀; Los Angeles County, California.]

General Characters.—Size relatively small to median. Surface dull. Head moderately to decidedly short and transverse when seen from dorsum, in cephalic aspect deeper than broad: fastigium excavated, lateral bounding walls marked, proportions varying in different subspecies, in general form hexagonal, but caudal limit undefined, greatest width of fastigium across lateral angles; interspace between eyes subequal to fastigial width; in profile moderately and obliquely (*L. c. cantator*) to strongly, broadly and arcuately (*L. c. kunzei*) declivent, facio-fastigial angle distinct but obtuse (*L. c. cantator*) to broadly arcuate and with no evident angle (*L. c. kunzei*), facial line appreciably retreating; frontal costa very broad, extremely so in *L. c. kunzei*, between antennal bases subequal to width of fastigium, decidedly (*L. c. cantator*) to hardly (*L. c. kunzei*) narrowed dorsad

[9] Proc. Entom. Soc. Wash., V, p. 162, (1903).
[10] Proc. Acad. Nat. Sci. Phila., 1904, p. 563, (1904).
[11] Biol. Cent.-Amer., Orth., II, p. 112, (1905).
[12] Proc. Acad. Nat. Sci. Phila., 1908, pp. 384–385, (1908).
[13] Ibid., 1910, pp. 432–434, (1910).

where it joints the fastigium, faintly narrowed at and ventrad of median ocellus, hardly (*L. c. kunzei*) or distinctly (*L. c. cantator*) reaching the clypeal suture, ventral part of lateral margins of costa as distinctly (*L. c. cantator*) to much more weakly (*L. c. kunzei*) defined and more poorly angled than margins of dorsal section; surface of frontal costa ranging from biseriately punctulate dorsad of median ocellus, and moderately excavate ventral of same (*L. c. cantator*), to virtually plane with a small and shallow impression about and briefly ventrad of median ocellus (*L. c. kunzei*): lateral facial carinae pronounced, straight, weakly diverging ventrad. Eyes prominent, particularly in male sex, ovate in basal outline, twice to half again as deep as length of infra-ocular sulcus. Antennae from slightly longer than (♀) to half again as long as (♂) the head and pronotum combined.

Pronotum faintly selliform, rather short, hardly substrangulate, median transverse sulcus alone severing median carina, other transverse sulci moderately indicated laterad, all relatively shallow; median carina distinct but relatively low and delicate; cephalic margin of disk truncato-arcuate; lateral lobes subquadrate to slightly deeper than long; ventro-caudal angle rather broadly rounded.

Tegmina surpassing apices of caudal femora by at least length of pronotum, median half virtually subequal in width, this contained slightly more than six to seven times in greatest tegminal length: costal margin in male broad arcuate over expanded section of marginal field, in female straight from the subobsolete proximal lobe to the distal section; sutural margin virtually straight: mediastine vein of male very short, reaching only to proximal section of expanded portion of marginal field. of female continued straight to the extremity of the same field, areolation of marginal field of male produced by a series of obliquely arcuate "herring-bone" like, closely placed, transverse nervures, approximately seventeen to nineteen in number, in female sex no clearly defined analogues of these nervures are present; humeral vein in male thickened and elevated on ventral surface in proximal five-eighths of tegmina, greatest thickening distad and paralleling greatly expanded section of marginal field, in female sex this vein is but little elevated and not appreciably thickened; intercalary area of tegmina in both sexes with a distinct and complete intercalary vein, which forms a regular double series of rectangulate areolets; ulnar area with a single series of relatively large areolets in both sexes. Wings with apices sharp, greatest width contained from two to two and one-third times in the greatest length of same.

Abdomen in male sex with dorsal surface weakly but appreciably deplanate, lateral borders of same evident but broadly rounded, the deplanate condition virtually absent in the female;

medio-longitudinal carina of abdomen pronounced but delicate, in female sex more apparent by reason of the general tectate form of the abdomen. Cerci of male simple, short, about one-half as long as supra-anal plate, tapering, acuminate apex faintly decurved. Subgenital plate short, bluntly conical produced.

Caudal femora with greatest width contained three and one-fourth to three and one-half times in greatest length of same.

Distribution.—This species is one of the Sonoran-Nevadan Desert area, ranging (see text-figure 2, page 63) from as far north as central western Nevada, south to the Mexican border, east to the region about Tucson, Arizona, and in southern California west to virtually the summits of the desert slope of the San Diegan Coast Range, the eastern slope of San Gorgonio Pass, and near the summit of Tehachapi Pass. In Arizona the escarpment of the great plateau appears to limit its northeastern distribution in that state, while it does not penetrate the country east of the Tucson region sufficiently to reach the Continental Divide. Along the Mexican border it is thus a species of the Western Desert Tract, and a western portion of the Elevated Central Tract, as defined by Mearns.[14] In Nevada it pushes northward up the lower valleys, but does not occur at any considerable elevation, and it is unknown from eastern Nevada north of Las Vegas. It is quite probable, from our knowledge of the preferred habitats, it will be found to occur in the Virgin River country of south-western Utah. Thus over the Gila, Colorado, Mohave and Amargosa Deserts this insect, in its different subspecies, ranges broadly, but its penetration north of the Amargosa is apparently limited to certain relatively low areas. Its zonal relationship is predominatingly Lower Sonoran, the subspecies *cantator* alone occurring in the Upper Sonoran Zone. What the extent of the species' distribution in Mexico may be, we cannot estimate, although there can be very little question but that it occurs over most of western Sonora and the northeastern portion of Baja California. No material has been recorded from Mexico.

Under the respective subspecies we have treated in detail their distributional areas and regions of intergradation.

[14] Bull. U. S. Nat. Mus., no. 56, pp. 31–32, pl. II, (1907).

Biological Notes.—Its characterization as a desert thamnophile would sum up the outstanding bionomic feature of this species. It is as truly bush-loving as any acridid of my acquaintance, and, as the above summary of its distribution shows, it is essentially a form of the deserts, part of them the most arid, sun and heat parched deserts in North America. It is perfectly at home in the depths of such below sea-level troughs as Death Valley and the Salton Depression, its only requirement being sufficient bush for food and shelter. Where the creosote bush (*Covillea tridentata*) grows it is usually the preferred host plant, in fact at many places *Ligurotettix* occurred on nothing else as far as we were able to observe. Its presence on other species, however, was frequently observed, and the subspecies *cantator* occurs almost wholly outside of the area inhabitated by *Covillea.* We are giving under the different races more complete information on host plants. In the blinding summer glare of the Gila, Colorado and Mohan Deserts the leaf clusters of *Covillea* offer more shade than the foliage of any other plant there found. Whether this may sway *Ligurotettix* in its choice, or whether it is a matter of food preference alone, remains to be determined. The usual position on *Covillea* is along and parallel to one of the main stems, ready on sufficient alarm to shift to the side away from the disturber, or if provocation is sufficiently great to make a quick flight to another bush. Slow movement of the observer does not produce such a marked effect, and a cautious approach frequently makes it possible to seize the insect between the fingers, in fact the majority of the large series taken was secured in this way. The position is often changed when slowly approached, a shifting up or down the stem, as if uncertain as to the intent of the intruder.

The stridulation of *L. coquilletti* is a succession of low but penetrating short notes, followed by a pause, then usually a repetition of the performance. Occasionally but a few encores will be given, but generally, unless disturbed, the musician continues his fiddling for a considerable time. The quick motion of the caudal femora is quite evident to the cautious and careful observer who has located a singing male. The femur is raised and then seen to be rapidly drawn, apparently, over the external surface of the closed tegmina. The file of the

internal surface of the caudal femora apparently rasps on the external (dorsal) surface of the veins of the humeral trunk, and probably more particularly of the thickened and stiffened discoidal vein. The whole structure of the marginal field would point to its function as a resonant apparatus.

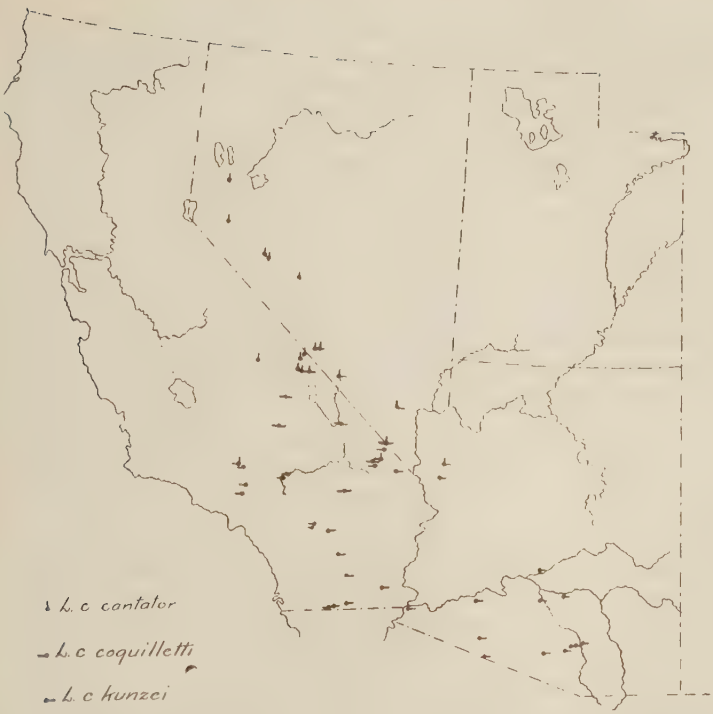
Remarks.—The species *coquilletti* is in many ways a most interesting one, if for no other reason than its illustration of the distribution of variational tendencies or influences in the Basin and Range Province and Western Desert Tract. These tendencies have operated to produce three fairly well defined geographic races in the species, which intergrade and prove thereby their specific unity. Under the individual races we have discussed their respective areas of distribution, and also the territory over which they intergrade. Here we wish simply to present the situation as a whole, with a few general deductions.

In southern Arizona we find one geographic race (*L. c. kunzei*) which extends westward typically across the Gila Desert and virtually all of the Colorado Desert of California. In the western Mohave Desert of California we have another subspecies (*L. c. coquilletti*) which typically has a much more limited distributional area, while in western Nevada we find a third form (*L. c. cantator*). The first of these comes in contact with the second near the northwestern edge of the Colorado Desert, while south of that on the eastern face of the San Diegan Coast Ranges the two intergrade. As the genus does not occur west of or on the main uplift of the Coast Ranges, this situation demonstrates the persistence and southward extent of the influence of *L. c. coquilletti*, as but a relatively few miles away to the east, at the foot of these slopes, true *L. c. kunzei* occurs. In this way the influence of *L. c. coquilletti* is limited to a very narrow area. In the Mohave Desert we find a most complicated intergradation of the three races. The western Mohavan *L. c. coquilletti* is typical eastward to the center of that area, while a marked strain of the same subspecies is found to the northeast in certain basins and along the dry course of the Amargosa. On certain of the relatively higher plateaus and ranges in this region, as is also true far to the west in the Tehachapi Mountains, the influence of the northern race *L. c. cantator* is apparent, and the material intermediate between this and *L. c. coquilletti*. In one

group of low mountains in this region (Bird Spring Mountains) we find the material combining all three subspecies, which is quite to be expected from the tendencies manifest in the surrounding country.

Over the Amargosa Desert southern of Nevada we find the strong *L. c. kunzei* and the more northern *L. c. cantator* influences in contact and the material intermediate, while in the general region of Death Valley and Panamint Valley to the westward is encountered a most interesting and instructive situation. On the Amargosa Range, east of Death Valley, we find, as would be expected from the relatively northern positionof the region, the more northern *L. c. cantator*, while in the depths of the Valley itself the insects are intermediate between the northern form and *L. c. kunzei*, which influence apparently has penetrated the region down the course of the Amargosa from the eastward. West of this region in Panamint Valley and at Searles Lake we find the material intermediate between the southeastern *L. c. kunzei* and the western Mohavan *L. c. coquilletti*.

The interdigitation of these races in the northern Mohavan and Amargosan regions is such that, apparently *L. c. kunzei* is the most vigorous and probably most adaptable stock, that it has pushed northward into the Amargosa Desert, limiting *L. c. cantator* to the higher elevations and blending with it over large areas, that it has also traversed the relatively or quite low Amargosa-Death Valley basin, there blending in a similar fashion with the more northern form, whose general territory it may be said to have more than entered at this point. Westward of Death Valley it appears to have pushed on at the lower levels and in the Panamint Valley and at Searles Lake again established contact with *L. c. coquilletti*, with which it there intergrades. On the higher levels in the Mohave to the southward *L. c. coquilletti* has maintained itself far to the eastward of the Amargosa-Death Valley basin region mentioned above, and kept its stock fairly typical to within a relatively short distance of the Colorado River. Again coming in contact with *L. c. kunzei* at lower levels in the south-central Mohave and western portion of the Colorado Desert, *L. c. coquilletti* intergrades with and then passes into the apparently more dominant form coming from the east.



Text figure 2.—Distribution of the genus *Ligurotettix* in the United States. The relationship of intermediate material is indicated by the combination of arms on the locality dot.

Key to Subspecies

A. Form of fastigium beyond line between lateral ocelli, including lateral foveolae, slightly acute to rectangulate in outline, with apex broadly truncate. Scutellum of fastigium relatively narrow, longitudinal, from narrowest point of vertex between eyes to apex of fastigium averaging distinctly (♂) or slightly (♀) narrower than long. Fastigio facial angle, in profile, moderately prominent and distinct, rather narrowly rounded, fastigium but moderately declivent. (General form more stocky.) (Typically, western Nevada, south into higher parts of Death Valley and Inyo regions of California.)

c. cantator new subspecies

B. Form of fastigium beyond line between lateral ocelli, including lateral foveolae, bluntly rectangulate, with apex very broadly and bluntly rotundato-truncate. Scutellum of fastigium broader, from narrowest point of vertex between eyes to apex of fastigium with length averaging approximately subequal to breadth (♂) or slightly shorter than broad (♀). Fastigio-facial angle, in profile, with fastigium more declivent than in A. (Typically, western Mohave Desert and extreme western Colorado Desert of California.)

c. coquilletti McNeill

C. Form of fastigium beyond line between lateral ocelli, including lateral foveolae, very broadly and roundly obtuse-angulate. Scutellum of fastigium very broad, the length from narrowest point of vertex between eyes to apex of fastigium averaging from faintly (♂) to decidedly (♀) less than breadth of same. Fastigio-facial angle, in profile, much more broadly rounded and less protuberant than in A and B; fastigium appreciably more roundly declivent. (General form more elongate.) (Typically, southern Arizona, west into the Colorado Desert and eastern Mohave Desert of California.)

c. kunzei Caudell

Ligurotettix coquilletti cantator New subspecies (Pl. VI, figs. 8-9.)

The present subspecies is of an average smaller size than the other two races of the species, and in form it is somewhat stockier. The more striking features of difference have been emphasized in the above key to the subspecies, but may be summarized by the statement that *L. c. cantator* has the fastigium more longitudinal and produced, as well as excavate, the fastigio-facial angle more marked and the fastigium less declivent than in the other forms.

Type.—♂; Mason, Lyon County, Nevada, Elevation, 4500–5700 feet. September 6, 1910. (Rehn and Hebard.) [Hebard Collection, Type no. 898.]

Description of Type.[15]—Size relatively small. Form relatively stocky. Angle of fastigium as seen from above, and including full areas of the lateral foveolae, acute, with apex, which is equal to two-fifths of base line between lateral ocelli, subtruncate. Disk of fastigium longitudinal, decidedly excavate, lateral marginal carinae well elevated, length of fastigial disk from narrowest point between eyes to apex distinctly greater

[15] Features of differential importance, or those having a direct bearing upon the former, alone are here given.

than greatest width, including lateral carinae. Lateral foveolae well impressed, rectangulate, greatest depth caudad. Frontal costa moderately broad, with greatest width between antennal bases, thence ventrad slightly narrowing to median ocellus and from that point subequal to clypeal suture; surface shallowly excavate from briefly dorsad of median ocellus to clypeal suture. Fastigio-facial angle, as seen in profile, moderately prominent, well advanced cephalad of lateral ocelli, apex of the angle itself narrowly truncate, though passing by an obtuse angulation into the but moderately declivent fastigial outline. Antennae slightly shorter than combined length of head and pronotum. Eyes relatively prominent, in dorso-ventral length equal to twice that of infra-ocular sulcus. Pronotum with median carina slightly more evident on metazona than on prozona, but appreciably elevated on latter. Tegmina surpassing apices of caudal femora by distance approximately equal to combined length of head and pronotum. Caudal femora moderately robust.

Allotype.—♀; same data as type. [Hebard Collection.]

Description of Allotype.—Differing from above description of type in the following noteworthy features. Angle of fastigium as seen from above rectangulate. Disk of fastigium with its length from narrowest point between eyes to apex slightly greater than greatest width of same, including lateral carinae. Frontal costa distinctly broader, both actually and relatively, than in male, but general form identical; surface with excavation ventrad of median ocellus subobsolete. Fastigio-facial angle essentially as in male, but immediate angle more rounded and outline of slope of fastigium more rounded. Tegmina surpassing apices of caudal femora by distance slightly less than length of head and pronotum combined.

Paratypic Series.—A series of nine males and four females bearing the same data as the type and allotype, and one of ten males and four females from Mina, Mineral County, Nevada, 4350–4850 feet, September 3–4, 1910, (Rehn and Hebard), are considered paratypes.

Morphological Notes.—As is true of the other forms of *Ligurotettix coquilletti* a very appreciable amount of variation in certain structural features is evident in the present form. The general angle of the fastigial outline varies to an appreciable degree, in the male sex from as described for the type to a somewhat more obtuse form, in fact but slightly less than a right angle.

The width of the excavated scutellum of the fastigium varies slightly, in proportion to the fluctuation of the fastigial outline. In the female sex the general outline of the angle of the fastigium ranges from slightly less than a right angle to fully rectangulate, while the excavated portion of the fastigium varies in the same proportion as in the male. In typical *cantator* there is a very slight amount of variation in the exact angle of the junction of the fastigium and face, at the fastigio-facial angle, as seen in profile, but this feature is only distinctly appreciable by a rounding of the angle when the material examined loses its typical *cantator* character, and, with this as one feature of its evidence, shows intergradation with *L. c. kunzei.* In common with the other forms of this species slight but appreciable bullation of the dorsum of the metazona, as seen in profile, is found in *L. c. cantator* as an individual variation. Two males of the Mina series, four females of the Millers series and several males of the Mason representation show this bullation, the majority quite weakly so, one male from Mason, however, with it well indicated. The tegmina in both sexes vary appreciably in length, for instance in males from Mason surpassing the apices of the caudal femora by from a distance equal to slightly more than the pronotal length, to one equal to the length of head and pronotum combined. The number of transverse nervures of the marginal field of the tegmina of the male varies from thirteen to nineteen, showing this range in the Mason series alone, while in the same representation is sufficient evidence to show that difference in the number on the two tegmina is often found. One from Mason has thirteen transverse nervures in this field of one tegmen and sixteen in the same area of the other tegmen, while two (Mina and Pilot Mountains) have seventeen and eighteen, another (Millers) sixteen and seventeen and one (Mason) seventeen and nineteen transverse nervures. The caudal femora, as in the other forms of this species, show appreciable variation in the proportion of breadth to length, which like the variation in the fastigial angle and number of transverse nervures of the marginal field of the male tegmina, is apparently individual. Taking the male sex alone the Mason series shows that the ratio of length to breadth varies from the latter being contained three times in the former to four times in the same.

The number of spines in the external margin of the caudal tibiae varies from eight to ten, with eight found in relatively few. The extremes are found in males from Mason and in both sexes from Mina, while a difference of one in the number of spines on the same margin of the two caudal tibiae is frequent.

Measurements (in millimeters)[16]

	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
♂					
Typical *L. c. cantator*					
Mason, Nevada, *type*	12.8	2.8	1.9	12.5	6.8
Mason, Nevada, *paratype*	11.5	2.5	1.8	11.1	6.6
Mina, Nevada, *paratype*	12	2.5	2	11.5	6.4
Mina, Nevada, *paratype*	13.4	2.8	2	12	7.1
Millers, Nevada	12	2.5	1.9	11.3	6.8
Millers, Nevada	14[17]	2.9	2	13.1	7.1
Daylight Spring, California	13.4	2.6	2.2	12.8	7.2
♀					
Mason, Nevada, *allotype*	19.8[17]	3	2.5	15.2	8.3
Mason, Nevada, *paratype*	16.7	3.2	2.4	13.8	8
Mina, Nevada, *paratype*	16.5	3.3	2.5	14.7	8
Millers, Nevada	17.5[17]	3	2.3	14.1	7.6
Millers, Nevada	16.5	3.1	2.3	15.2	8.5
Intermediates between *L. c. cantator* and *L. c. coquilletti*					
♂					
Cima, California	13.4	2.9	2	12.5	7.2
Cima, California	14.2	2.9	2.2	13.4	8
♀					
Cima, California	17.6	3.5	2.6	15	8.9
Cima, California	17.5	3.4	2.7	16.6	9.4
Intermediates between *L. c. cantator* and *L. c. kunzei*					
♂					
Beatty, Nevada	12.9	2.7	2.2	12.6	7.5
Beatty, Nevada	13.5	2.9	2.2	13.8	7.8
Las Vegas, Nevada	12.5	2.9	2.4	12.2	7.8
Las Vegas, Nevada	15	3.1	2.3	14.1	8.2
Emigrant Wash, California	14.5	2.7	2.4	14	8.7
Emigrant Wash, California	16.8	3.3	2.5	15.2	9
Kingman, Arizona	13.2	3	2.4	13.2	8.4

[16] The dimensions given in this paper are generally of extremes in each series.
[17] Abdomen somewhat abnormally compressed and extended.

	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
♀					
Beatty, Nevada	19.2	3.4	2.7	16.2	9
Beatty, Nevada	18.5	3.5	2.8	17.1	9.2
Las Vegas, Nevada	20.5	3.8	3	17	10
Las Vegas, Nevada	18.7	3.8	3.2	18.5	10
Emigrant Wash, California	17.3	3.5	2.9	16	9.4
Emigrant Wash, California	22.2	4.2	3.4	20	11.5
Kingman, Arizona	18.5	3.5	2.6	17.1	9.2
Kingman, Arizona	22.1	4	3	18.5	10.3
Intermediate between all three subspecies					
♂					
Bird Spring Mountains, California-Nevada	13.8	3.2	2.4	12.6	8.2
Bird Spring Mountains, California-Nevada	14.2	2.5	2	14.2	8
♀					
Bird Spring Mountains, California-Nevada	19.5	3.4	2.5	17	9.8
Bird Spring Mountains, California-Nevada	21	3.9	2.8	18.8	10.5

It is evident from the above tables that very appreciable individual size variation is found at virtually every locality represented by series of any size. It is equally apparent that tegminal length varies entirely out of proportion to the length of the pronotum and of the caudal femora.

The increase in size southeastward, as the territory of *L. c. kunzei* is approached, is quite evident, while the *L. c. coquilletti* strain shows far less response in size increase. These size tendencies are average, and are not indicated in all from a locality, as witness the extremes of the female sex from Emigrant Wash, which represent the extremes for the sex of that type in two measurements, and very close to the extremes in two others.

Color Notes.—The general color pattern of the three races of *L. coquilletti* is an inconspicuous ground color, generally paler on the dorsal surface, and even more so on the face, with distal, postmedian and median dark barring on the dorsal surface of the caudal femora, encrouching upon the external face to a variable degree. The base color is rarely nearly immaculate, being generally overlaid with a darker pattern of fine punctulations,

tegminal vein pencillings and small rectangulate maculations which are usually areolar in extent. A pattern feature which is probably genetic, clearly not geographic or sexual, and not restricted to any one race, is a solid infuscation of the post-and infra-ocular portions of the genae, of the prozonal portion of the lateral lobes and of most of the pleura.

In the present form, as represented by typical material, the base color ranges from pale pinkish buff and very pale ash gray, to avellaneous (Ridgway), drab and hair brown. The overlying dark pattern, when appreciably indicated, ranges in tone from olive-brown to fuscous-black. The infuscation of the lateral areas of the head and pronotum and of the pleura, as far as available material is concerned, is never as completely or solidly indicated in typical material of *cantator* as in the other races, although in intermediates between it and the other forms this condition is frequently evident. A male from Millers, Nevada and one from the Pilot Range, in the same state, show the greatest development of this feature, while a female from Mina and another of the same sex from the Bullfrog Hills, Nevada, have indications of a less solid character. In the two males mentioned above, traces of the dark color extend caudad over the extreme dorsal portion of the metazonal section of the lateral lobes. This is also true of a male from Beatty, Nevada, intermediate between *cantator* and *L. c. kunzei*, while a number of both sexes from the foothills of the Bird Spring Mountains, California–Nevada, intermediate between all three subspecies of *coquilletti*, and a male and several females from Cima, California, intermediate between *cantator* and *c. coquilletti*, show this same lateral lineation of the metazonal section of the lobes.

The eyes range in color from uniformly pale ochraceous-tawny to dresden brown speckled with fuscous. The caudal tibiae range from the very pale general color to extremely weak glaucous, the distal extremity, except dorsad, the distal section of the spines and proximal cloudings, infuscate.

Considered geographically, in color characteristics, the series are relatively uniform. The Mason representation is dull, quite grayish, with little contrast and few, yet distinct, punc-

tulae and vein lineations, these as is a general rule less apparent in the males than in the females. The Mina series is equally dull, but slightly more reddish in tone. The Millers series is more contrasted, the dorsal surface paler than the lateral, occasionally (two females) appreciably washed with hoary white, while the punctulae and vein lineations are quite distinct in the female, much less distinct or almost non-existent in the male. In all cases the humeral trunk is lineate, even when other tegminal pattern is not evident. The relatively large series from Emigrant Wash, intermediate between the present form and *L. c. kunzei*, is remarkable in color, being exceedingly pale with a marked but not intense cinnamon-rufous wash, and the maculations, except on the caudal femora, subobsolete or very finely pencilled. One of the females of this representation has the pronotal and pleural infuscation of the type more prevalent in *kunzei*. The single Salt Well female and that from Death Valley slopes at 1000 feet elevation, are similarly cinnamon-rufous washed, showing this is a condition of the lower levels of the Death Valley region. The Beatty series has pallid, but little marked, males and distinctly punctulate and lineate females. The Shoshone male is very pale, with the only marked contrast in the barring of the caudal femora. The two Warren males, intermediate between *cantator* and *L. c. coquilletti*, are quite dark, dull and little contrasted, in color much like Mohave individuals of true *coquilletti*. The individuals from the foothills of the Bird Spring Mountains, which connect all three subspecies of *coquilletti*, are much contrasted in coloration, but this is chiefly by reason of the large percentage (four males, four females) of individuals with infuscate pronotal lobes, combined with a generally correlated pronounced and extensive barring of the caudal femora.

Distribution.—In its typical condition the subspecies *cantator* is found only in the western and southwestern portions of the Nevada Basin of the Basin and Range Province of the United States,[18] as far as known extending northward to Fernley, Lyon County, Nevada, eastward to Millers, Esmeralda County in the same state, and westward into the Californian section of the same basin. On the south typical *cantator* is found on the Amargosa Range at Daylight Springs, at 4350 feet, while

[11] See Fenneman, Annals Assoc. Amer. Geographers, VI, pp. 34, 35, 42, 88–92, map, (1917).

lower down on either side of the range the individuals of *Ligurotettix* are intermediate between the subspecies *cantator* and *kunzei*, thus showing an intrusion from the southeast of the *kunzei* influence. On the west side of the Amargosa Range atypical *cantator* is found at Hole-in-the-Rock Spring, at 2500–2900 feet elevation, and the material from the Inyo Mountains, in California, is of similar character. The interdigitation and intergradation of *c. cantator* and true *coquilletti*, and *c. cantator* and *coquilletti kunzei* is hard to express in words, and we would refer the student to the accompanying map (see page 63) to assist him in following our remarks. An understandng of the physiography of southern Nevada and California and western Arizona, will assist greatly in comprehending the involved situation presented. Intermediates between *c. cantator* and *c. coquilletti* are known from Warren, Kern County, California, on the desert slope of the Tehachapi Pass, as well as from Cima, San Bernardino County in the same state. Both localities are on high slopes and divides and in the belt of tree yuccas which indicates the upper portion of the Lower Sonoran Zone, into which from more northern regions the *cantator* influence appears to penetrate, thus meeting the true *coquilletti* influence of the lower levels of the western and most of the northern Mohave Desert. Intergradation with *c. kunzei* is through the penetration of the deep depression of Death Valley by the *kunzei* type from the southeast, and on the lower levels of southern Nevada from the Bullfrog Hills east to Las Vegas. Material from Kingman, Mohave County, Arizona, on the western slope of the great Arizona plateau is similarly intermediate, this being the last point to the southeast where the influence of *cantator* is apparent. In the foothills of the Bird Spring Mountains on the California-Nevada line near Lyons (now Desert), California, we find material which combines very definitely all three subspecies of the *coquilletti* complex. Under *L. c. coquilletti* we have discussed certain points in connection with the distribution of the other subspecies, with which *cantator* is little involved.

In vertical distribution the subspecies *cantator* typically is known from as low as 4157 feet (Fernley) at the northern point of its range, to as high as 5300 feet on the Pilot Mountains near Mina, Nevada. Atypical material has been seen which

was said to be from as high as 7000–9000 feet (Inyo Mountains, California), but we cannot help questioning the correctness of the altitude given. Material intermediate between *L. c. cantator* and *L. c. coquilletti* ranges in elevation from 3360–3500 feet (Warren) to 4192 (Cima), while intermediates between *L. c. cantator* and *L. c. kunzei* range from as low as 21 feet below sea-level (Salt Wells) to as high as 4000 feet (Bullfrog Hills).

Ligurotettix coquilletti cantator is typically a form of the Upper Sonoran Life Zone, Daylight Springs being the only locality represented by typical material which is in the Lower Sonoran Zone. This latter locality, however, is at the summit of a pass, with conditions much approximating those of the higher zone.

Biological Notes.—The scattered gray green bush of the Nevadan Basin, a land of broad desert plains and valleys and long mountains ranges, is the favored habitat of this subspecies. (see plate VII, fig. 2). In the Great Basin greasewood (*Sarcobatus*), in *Atriplex*, and other species of the wiry and spiny shrubs which sparsely clothe the valleys and lower mountain slopes of this region, it will be found at home. In but two places (Daylight Spring and Hole-in-the-Rock Spring) was it found on creosote bush (*Covillea*), which is so much favored by the other subspecies, which is readily understood when it is realized that this plant is almost absent from the area occupied by true *cantator*. Intermediates between *cantator* and the other subspecies frequently occur on creosote bush. This subspecies was noted by Hebard as stridulating after dark, the two specimens from Fernley, Nevada, being taken by stalking their sound well after night had fallen. Many others were stridulating at the same time in the brush of a *Sarcobatus* flat, and as long as the air remained warm and still they continued their performance. On the passing of a shower accompanied by a cool wind the entire assemblage ceased stridulating and nothing further was heard.

The earliest date represented by material before us in July 7 to 11 (Inyo Mountains), although in our own collecting we have never found it earlier than August 13 (Daylight Spring), but this is doubtless due to our never having been within the territory of the present subspecies earlier in the year than the month of August. Our records extend to September 6 (Mason),

although material intermediate between *c. cantator* and *c. coquilletti* was secured as late as September 17 (Warren). There is little doubt in our mind that in the more southern part of its range, *cantator* occurs well into October, but in the more northern section the early frosts have probably killed off the insects before that time. We have no information upon the immature stages of the subspecies.

Specimens Examined: 129; 75 ♂, 53 ♀, 1 immat. ♀.

Typical *L. coquilletti cantator*

NEVADA: Fernley, Lyon County, VIII, 26, 1922, (H.; in bushes of *Sarcobatus* flat), 2 ♂. Mason, Lyon County, 4500–5700 feet, IX, 6, 1910, (R. & H.; in dense thorny bushes), 10 ♂, 5 ♀. Mina, Mineral County, 4350–4850 feet, IX, 3–4, 1910, (R. & H.; in desert spiny bushes on alluvial slopes), 10 ♂, 4 ♀. Pilot Mountains, east of Mina, Mineral County, 4800–5300 feet, IX, 3, 1910, (R. & H.; common, as at Mina, but not seen above 5300 feet), 2 ♂. Millers, Esmeralda County, VIII, 27, 1922, (R. & H.; frequent, particularly in *Atriplex*), 3 ♂, 5 ♀.

CALIFORNIA: Daylight Spring, Grapevine Mountains, Inyo County, 4350 feet, VIII, 13, 1919, (R. & H.; few in creosote bush), 1 ♂.

Atypical *L. coquilletti cantator*

CALIFORNIA: Hole-in-the-Rock Spring, Boundary Canyon, Amargosa Range, Inyo County, 2500–2900 feet, VIII, 13 and 16, 1919, (R. & H.; occasional in creosote bush), 2 ♂, 1 ♀. Inyo Mountains, 7000–9000 feet, VII, 7–11, (Wickham), 1 ♂, [Hebard Cln.].

Intermediate between *L. coquilletti cantator* and *L. coquilletti coquilletti*

CALIFORNIA: Warren, Kern County, 3360–3500 feet, IX, 17, 1910, (R. & H.; not common in creosote bush on slopes and in dense gray bushes of wash), 2 ♂. Cima, San Bernardino County, 4192 feet, VIII, 12, 1907, (H.), 3 ♂, 3 ♀, [Hebard Cln. and A. N. S. P.].[19]

Intermediates between *L. coquilletti cantator* and *L. coquilletti kunzei*

NEVADA: Bullfrog Hills, Nye County, VIII, 11, 1919, (R. & H.; moderately abundant and generally distributed), 1 ♂, 3 ♀. Beatty, Nye County, VIII, 9–12, 1919, (R. & H.; common in creosote bush and other shrubs on flat and mesa), 5 ♂, 3 ♀. Ash Meadows, Nye County, VIII, 14–19, 1921, (Knaus, Nininger and Hoover), 2 ♂, [Hebard Cln.]. Las Vegas, Clark County, 2026–2050 feet, VIII, 10, 1907, (H.), 7 ♂, 2 ♀, [Hebard Cln. and A. N. S. P.];[19] IX, 2, 1909, (R. & H.; very abundant in bush in a few locations), 1 ♂, 1 ♀.

CALIFORNIA: Emigrant Wash, Panamint Range, above Death Valley, Inyo County, 2000 feet, VIII, 14, 1919, (R. & H.; very common), 12 ♂, 12 ♀. Salt Well, foot of Emigrant Wash, Death Valley, Inyo County, 20 feet below

[19] Recorded as *Ligurotettix coquilletti* by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1910, p. 432, (1910).

sea-level, VIII, 14, 1919, (R. & H.; few). 1 ♀. Death Valley slopes, opposite Boundary Canyon, Inyo County, 1000 feet, VIII, 16, 1919, (H.; in creosote bush), 1 ♀.

ARIZONA: Kingman, Mohave County, 3336–3500 feet, VIII, 2, 1919, (R. & H.; moderately numerous in dry desert bushes), 2 ♂, 2 ♀: VIII, 2, 1920, (O. C. Poling), 1 ♀, [Hebard Cln.].

Intermediate between *L. coquilletti cantator*, *L. coquilletti coquilletti* and *L. coquilletti kunzei*

CALIFORNIA-NEVADA: Foothills, Bird Spring Mountains, McCullough Range, San Bernardino County, California, and Clark County, Nevada, VIII, 11, 1907, (H.; on creosote bush), 9 ♂, 9 ♀, 1 immat. ♀, [Hebard Cln. and A. N. S. P.].[20]

Ligurotettix coquilletti coquilletti McNeill (Pl. VI, figs. 10-11.)

1897. *Ligurotettix coquilletti* McNeill, Proc. Davenport Acad. Nat. Sci., VI, p. 258 pl. V, figs. 24, 24a, 24b, 24c. [♂, ♀; Los Angeles County, California.]

1900. *Ligurotettix coquilletti* Scudder, Psyche, IX, p. 95. (Part.) [Palm Springs and Lancaster, California.]

1905. *Ligurotettix coquilletti* Bruner, Biol. Cent.-Amer., Orth., II, p. 112. (Part.) [Los Angeles County, California.]

1910. *Ligurotettix coquilletti* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1910, p. 432. [Cottonwood, Kelso, Cima,[21] North Range of Providence Mountains,[22] California; foothills of Bird Spring Mountains, California-Nevada;[23] Las Vegas, Nevada.[21]]

The typical form of *Ligurotettix coquilletti* is of somewhat greater average size than in *L. c. cantator*, the form more elongate; the fastigium is broader, less protuberant and less sharply angulate, when seen from above, than in the same race. In lateral profile the fastigio-facial angle is less pronounced, with the fastigial line more declivent, although the angle is not as rounded or as little evident as in *L. c. kunzei*, neither is the fastigium as broad and as blunt as in the latter race. The features of difference have been elaborated in the key given on pages 63-64. Typical *coquilletti* is a form of the western Mohave Desert

[20] Recorded by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1910, p. 432, (1910), as *Ligurotettix coquilletti*.

[21] Intermediate between *L. c. coquilletti* and *L. c. cantator*, and *c. cantator* and *c. kunzei* for which see page 73.

[22] Intermediate between *L. c. coquilletti* and *L. c. kunzei*. The locality was quoted as "North Range of Providence Mountains," and we now prefer (see page 82, footnote 25) to use for this point: Foothills two miles south of Kelso Peak, north of Kelso, California.

[23] Intermediate between all three subspecies of *coquilletti*, see above.

and the extreme western portion of the Colorado Desert. Its intergradation with the other subspecies is discussed elsewhere.

This species, and consequently subspecies, was described from three males and two females in the United States National Museum, collected by Coquillett. These specimens were undoubtedly collected on the desert (Mohave) side of the Sierra Madre (San Gabriel - San Bernardino) range in Los Angeles County, as the genus does not occur on the valley side of that barrier. Mr. Caudell has kindly examined the type material in the National Museum and has indicated a single type as follows:

Single Type.—♂; Los Angeles Co[unty], Cal[ifornia]. (Coquillet[t] collector.) [United States National Museum, Type no. 3675.]

The National Museum possesses more material bearing the typical data than was examined by McNeill, also material taken by Coquillett in San Bernardino County. None of the latter material have any claim to be considered as having type value, although at one time so catalogued at the National Museum. The same is true of all Los Angeles County material other than the five originally examined by McNeill. A male and a female belonging to the latter category are before us, having been received in exchange from the National Museum.

General Characters.—True *coquilletti* in some respects is intermediate in development between the other two subspecies. The form is more slender than in *L. c. cantator*, but as an average not as elongate and attenuate as in *L. c. kunzei*. The fastigial form has the lateral arms of the angulation approximately rectangulate in their relative positions, with the whole projection cephalad of the fastigium more evident than in *L. c. kunzei*, as the profile outline also demonstrates. The scutellum of the fastigium is intermediate in width between the types found in *L. c. cantator* and *L. c. kunzei*; in the male sex the portion cephalad of the narrowest point of vertex is subequal to the length of the same, in the female sex the width (greatest) is slightly more than the length. In profile the fastigio-facial angle, while still prominent and in no way as broadly rotundato-arcuate as in typical *L. c. kunzei*, is less evident than in *L. c. cantator*. If it were not that typical *coquilletti* occupies a definite geographic area, over which it is constant in features, and that it passes over well defined areas into the other two subspecies

of the species complex, the argument might be advanced that true *coquilletti* represents simply an intermediate condition between the other forms, which are, morphologically speaking, at opposite poles of the species' range. This argument, however, would fall after examining the actual material involved, as a region of relative uniformity for *L. c. coquilletti* is clearly indicated, while the intergradation with *L. c. cantator* and *L. c. kunzei* is of exactly the character and the limited areal extent usual between geographic subspecies.

Morphological Notes.—The general angle of the fastigial outline varies from bluntly rectangulate to truly rectangulate in both sexes, this, of course, embracing the lateral foveolae in a comprehensive view from the dorsum. The width of the excavated scutellum of the fastigium varies in the male sex from of subequal length and breadth (as measured in key on pages 63–64) to appreciably narrower than long; in the female sex, while somewhat variable, almost always slightly broader than long. The exact flash-shape of the scutellum varies somewhat, as is true of the other subspecies, often without affecting the major proportions. The fastigio-facial angle, as seen in profile, shows appreciable but slight variation in degree and of the declivity of the fastigial line, but the degree of the declivity is always greater than in *L. c. cantator*, while the angle itself is never as subobsolete as in typical *L. c. kunzei*. Bullation of the metazona of the pronotum is strongly indicated in one male from Acton and weakly evident in seven males (Barston, 1, Mohave, 3, Palm Springs to Palm Canyon, 3), and three females (Mohave, 2, Palm Springs to Palm Canyon, 1), The tegminal length shows, in the Mohave series alone, variation in relation to the femoral apices as great as described under *L. c. cantator*. The number of transverse nervures of the marginal field of the tegmina of the male varies from fifteen to twenty-one, with seventeen the average number. The two Cottonwood males alone show sixteen and twenty-one nervures, although in specimens of this subspecies difference between the number found on the two tegmina is slight. The caudal femora vary in width from three and a third to two and seven-eighths times as long as broad in the male sex, and from three and two-thirds to three and one-fifth times as long as broad in the female.

The number of spines on the external margin of the caudal tibiae, as in *L. c. cantator*, varies from eight to eleven, with eight and eleven in very few and ten the usual quantity. The extremes are found in the male sex and from Mohave alone.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
Typical *L. coquilletti coquilletti*					
Mohave, California	13.5	2.6	2.3	12	7.2
Mohave, California	15.4	3.1	2.4	14.6	8.9
Barstow, California	14.1	3.1	2.5	13.6	8.2
Acton, California	13.5	2.6	2.3	12.6	7.5
Atypical *L. coquilletti coquilletti*					
Lyons, California	14.2	2.9	2.2	14	8
Kelso, California	13.6	3	2.2	13.5	8.1
Kelso, California	14.3	3	2.4	14	8.2
Palm Springs to Palm Canyon, California	15.2	3	2.3	14.4	8.4
Palm Springs to Palm Canyon, California	18.4	3.4	2.7	17	9.4
Intermediate between *L. coquilletti coquilletii* and *L. coquilletti kunzei*					
Trona, California	13.5	3	2.1	14	8
Panamint Valley, California	16.5	3.2	2.4	14.2	8.5
Bagdad, California	15.1	3.1	2.5	14.2	8.5
Bagdad, California	16.5	3.4	2.6	15.9	9.2
Wagon Pass, California	16.3	3.2	2.5	15.5	8.8
♀ Typical *L. coquilletti coquilletti*					
Mohave, California	18.8	3.6	2.6	15.5	9.3
Mohave, California	21.2	4	3	17	10.2
Barstow, California	20.3	4	2.9	18.6	9.5
Acton, California	18.6	3.3	2.8	15.3	8.7
Atypical *L. coquilletti coquilletti*					
Lyons, California	19	3.8	3	17.4	9.6
Lyons, California	20.3	4.2	3.1	18.1	10.4
Kelso, California	21	4	3.1	18	10.2
Kelso, California	23.2	3.8	3	19.6	11.2
Palm Springs to Palm Canyon, California	22.5	3.8	2.9	19.5	10.2
Palm Springs to Palm Canyon, California	22.5	4.4	3.4	21	12

♀	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
Intermediate between *L. coquilletti coquilletti* and *L. coquilletti kunzei*					
Trona, California	19.6	3.9	2.6	18	9.6
Panamint Valley, California	21	3.9	3	18.5	10.5
Foothills south of Kelso Peak, California	19.5	3.7	2.7	17.8	10
Bagdad, California	21	3.9	2.8	18	10.2
Bagdad, California	24.5	4.6	3.6	20.8	12.2

As we have remarked under *L. c. cantator*, which is equally true of the present subspecies, the tables of measurements indicates that appreciable individual size variation is found at most localities represented by series. The average size of the individuals measured above shows the greater size of *L. c. coquilletti* as compared with *L. c. cantator*.

Color Notes.—The present subspecies typical is duller in coloration than typical material of the other forms of *coquilletti*, the femoral bars less conspicuous and the overlying punctulation less evident. The general base color approaches wood brown, fawn color and clay color, becoming drab gray in Barstow and Cottonwood individuals, with tawny touches in certain Mohave specimens. The tegmina show pale neutral gray under the rather finely punctulate pattern, which is olive brown to fuscous brown as in the other forms. The Mohave and Acton series are very dull and somber, as is also true of the Warren specimens. The Barstow specimens are brighter with more gray tones, while the Palm Springs to Palm Canyon males are paler than the Mohave individuals with a more ochraceous appearance. The females, however, from the latter locality are quite dull, but appreciably punctulate. The atypical Kelso and Lyons series are quite pale, approaching cinnamon-buff with few punctulations but distinct femoral bars on the dorsal surface; the females of both are much darker, although the Kelso ones are the more buffy, the Lyon ones the more fuscous of the two lots.

No specimens of true *coquilletti* show the black collar present on the pronotum, although material intermediate between it

and *L. c. kunzei* is so marked, and two males of atypical *coquilletti* from Palm Springs to Palm Canyon have solidly fuscous prozonal lateral lobes. The eyes range from ochraceous-tawny to mars brown, while some individuals have them dresden brown. The caudal tibiae range in color from chamois and horny yellow to pale dull glaucous marked with mummy brown.

Geographically considered the Kelso material shows apparent "bleaching," followed in this by the Palm Springs to Palm Canyon series. The Cottonwood and Barstow specimens are more grayish than any others; the large Mohave representation and those from Warren Acton are dull and brownish.

Distribution.—The western half of the Mohave Desert of California is the territory inhabited by the typical form of *L. coquilletti*, which ranges from the lower slopes of the Tehachapi and San Gabriel Mountains eastward typically as far as Barstow, on the Mohave River. On the slopes of Tehachapi Pass, at Warren, it intergrades with *L. c. cantator*, which is also the case at Cima, San Bernardino County, where on a relatively high divide the influence of the more northern *cantator* is evident. Nothing is known of the occurrence of this subspecies in Baja California, Mexico, and it is very questionable whether it extends far in that direction, although *L. c. kunzei* probably does occur over a considerable territory on that side of the boundary. Along the eastern escarpment of the Coast Range of San Diego County, at Jacumba and Wagon Pass, *c. coquilletti* intergrades with *c. kunzei*, which latter, in its typical or an atypical form, occupies the Salton Depression and the Imperial Valley. Along the eastern foot of the San Jacinto Mountains, at the western edge of the Colorado Desert the *Ligurotettix* material is atypical *coquilletti* (about Palm Springs), showing that there is a small belt along the foot of these mountains where *c. coquilletti* does not give way to *c. kunzei* of the great desert area stretching eastward. We know nothing concerning the character of *Ligurotettix* as found on the lower (desert) slopes of the San Bernardino Mountains. In the northeastern arm of the Mohave the *coquilletti* tendency is quite persistent on the lower levels, as at Kelso and Lyons (now Desert), California the material is atypical *coquilletti*.

The mingling of *c. coquilletti* and *c. kunzei* along the northern border of the former's distribution is the most puzzling feature in the distribution of the genus. Material from the Panamint Valley floor, from Trona, on Searles Borax Lake, at Shoshone in the Amargosa and from the foothills north of Kelso, is intermediate between these two races, while on the foothills of the Bird Spring Mountains, as already pointed out (see pages 61-62), the individuals show a complete blend of all three subspecies of *coquilletti*. For our conception of the causes producing this great extension of the influence of *c. kunzei* to the northward and encircling in that direction the area of distribution of typical and atypical *coquilletti*, we refer the student to our general analysis of the species (see pages 61 and 62). In east-central portion of the Mohave, at Bagdad, we found the material intermediate between *L. c. coquilletti* and *L. c. kunzei*. This shows the penetration of the Mohave by the *kunzei* influence is not as great as in the Colorado Desert, where typical *kunzei* is found as far west as Coyote Wells, on the lower slopes of the eastern escarpment of the San Diego Coast Range.

In vertical distribution *L. c. coquilletti* typically is known from elevations between 2100 (Barstow) and 2750 feet (Mohave). Atypical material has been taken as low as 450 to 480 feet (Palm Springs to Palm Canyon), but aside from the representation from the Palm Springs region we have seen similar material only from 2118 (Kelso) to 3000 feet (Lyons). Material intermediate between *L. c. coquilletti* and *L. c. kunzei* has been examined from elevations between 650 (Bagdad) and 3700 feet (Wagon Pass). It is evident that actual elevation is of less importance in influencing the intergradation of the forms of this species, than the apparent regional dominance of racial tendencies.

Ligurotettix coquilletti coquilletti is always a form of the Lower Sonoran Life Zone, even the intermediates between it and the other subspecies not occurring outside of the boundary of that zone except at Wagon Pass and Jacumba, which are just within the Upper Sonoran Zone.

Biological Notes.—Over a very large part of the Lower Sonoran Zone area of our southwestern states the creosote bush (*Covillea tridentata*) or "greasewood" of the Mexican border is found.

Often it occurs to the exclusion of other plants, again it is associated with a number of other species. Spaced well apart as usual with desert plants, its olive green foliage is a restful break to the glare of the yellows and whites of the bare soil, as the brilliant light and burning heat of a cloudless summer day assail the eye. The foliage is grouped in terminal tufts on the long bare stems, and the latter furnish *Ligurotettix* with a favorite resting place. The forms *coquilletti* and *kunzei* are extremely partial to creosote bush, which occurs over by far the greater part of the territory occupied by these two subspecies. Occasionally the country is exceedingly arid and sterile, as at Lyons, where the slopes on which the creosote bush grew were covered with volcanic fragments, and at Bagdad, in a deep depression with a saline sink, where the sun parched and browned greasewood grew on sand and gravel. At both of these places *Ligurotettix* was present and thoroughly at home. At Palm Springs colonies of a dozen or more individuals were found in a single bush of the favorite host plant.

True *coquilletti* frequently occurs in other plants than *Covillea*, but almost invariably this is true only of localities where the latter species is absent.

The earliest dates represented by material before us are August 6 (Bagdad) and August 7 (Barstow), although Scudder reports material taken by Morse on July 12 (Palm Springs), while individuals were secured by us as late as September 30 (Tahquitz Canyon). As the latter record is from within a few miles of the locality where it was taken by Morse on July 12 (Palm Spring), it is evident we have at least three months and a half as the known seasonal adult life of the species in the same territory. This does not, however, represent to our mind the full season, as we feel certain it extends very much later than the end of September.

Specimens Examined: 111; 72 ♂, 39 ♀.

Typical *L. coquilletti coquilletti*

California: Mohave, Kern County, 2750 feet, IX, 15–16, 1910, (R. & H.; common in creosote bush), 25 ♂, 10 ♀. Barstow, San Bernardino County, 2100 to 2600 feet, VIII, 7, 1919, (R. & H.; few in creosote bush on lava butte), 2 ♂, 1 ♀. Acton, Los Angeles County, 2700 feet, IX, 27, 1910, (R. & H.; not common in low bush), 4 ♂, 1 ♀.

Atypical *L. coquilletti coquilletti*

CALIFORNIA: Lyons (now Desert), San Bernardino County, 2800–3000 feet, IX, 1, 1909, (R. & H.; very common in creosote bush on slopes), 3 ♂, 5 ♀. Kelso, San Bernardino County, 2118 feet, VIII, 12, 1907, (H.; plentiful on creosote bush), 4 ♂, 2 ♀[24]. Cottonwood Station, Mohave River, San Bernardino County, 2274 feet, IX, 9, 1907, (H.; common in creosote bush), 2 ♂, 1 ♀.[24] Palm Springs to Palm Canyon, Riverside County, 450–480 feet, IX, 29, 1910, (R. & H.; very plentiful in creosote bush), 18 ♂, 8 ♀. Tahquitz Canyon, San Jacinto Mountains, Riverside County, 500–1200 feet, IX, 30, 1910, (R. & H.; in creosote bush on alluvial fan), 1 ♂.

Intermediate between *L. coquilletti coquilletti* and *L. coquilletti cantator*

See page 73.

Intermediate between *L. coquilletti coquilletti* and *L. coquilletti kunzei*

Panamint Valley, opposite Hall Canyon, Inyo County, 1500 feet, IX, 6, 1922, (R. & H.; few in creosote bushes), 1 ♂, 2 ♀. Trona, San Bernardino County, 1700 feet, IX, 5, 1922, (R. & H.; very few and local in creosote bush), 2 ♂, 2 ♀. Shoshone, Inyo County, 1566 feet, VIII, 8, 1919, (H.; few in creosote bush), 1 ♂. Foothills two miles south of Kelso Peak, north of Kelso, Bernardino County, 2200–2300 feet, VIII, 12, 1907, (H.), 1 ♀.[25] Bagdad, San Bernardino County, 650–800 feet, VIII, 6, 1919, (R. & H.; common in sunbrowned creosote bush on gravel and sand plain), 7 ♂, 6 ♀. Jacumba, San Diego County, 2800–2900 feet, IX, 15, 1922, (R. & H.; few in bush along desert wash), 1 ♂. Wagon Pass, Coast Range, eight miles east of Jacumba, San Diego County, 3700 feet, IX, 15, 1922, (R. & H.; moderately common), 1 ♂.

Intermediate between *L. coquilletti coquilletti*, *L. coquilletti kunzei* and *L. coquilletti cantator*

See page 74.

Ligurotettix coquilletti kunzei Caudell (Pl. VI, figs. 5–7, 12–13.)

1900. *Ligurotettix coquilletti* Scudder, Psyche, IX, p. 95. (Part.) [Yuma, Arizona record only.]

1903. *Ligurotettix kunzei* Caudell, Proc. Entom. Soc. Wash., V, p. 162. [♂, ♀; Phoenix, Arizona.]

1904. *Ligurotettix kunzei* Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 563. [Florence, Arizona.]

1905. *Ligurotettix coquilletti* Bruner, Biol. Cent.-Amer., Orth., II, p. 112. (Part.) [Needles, California; Yuma, Arizona.]

1905. *Ligurotettix kunzei* Bruner, Ibid., p. 112. [Phoenix and Florence, Arizona.]

[24] Recorded by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1910, p. 431, (1910)).

[25] This locality is the same as "North Range, Providence Mountains," as previously used by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1910, p. 432, (1910)). The name for the locality given above seems more applicable and diagnostic than that previously used.

1908. *Ligurotettix kunzei* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1908, p. 384. [Tucson, Sonora Road Canyon, Roebles Ranch, Sentinel and Yuma, Arizona.]

The present subspecies of the *coquilletti* complex has the most extensive distribution of any of the three components, is of average larger size and apparently is the most vigorous race. What extent of territory in Mexico is occupied by it remains to be determined, thus the remarks here made are based solely on our knowledge of *kunzei* within the United States. Its chief distinguishing feature is the shorter and broader fastigium, scutellum as well as general outline, the whole less produced than in the other subspecies. In profile the fastigio-facial angle is, in consequence, less protuberant and very broadly rounded, with the fastigial line roundly declivent. The general form also is more elongate than in *L. c. coquilletti* and *L. c. cantator*.

This subspecies was based on a pair, taken at the type locality, September 10, 1902, by Dr. R. E. Kunzé, now in the collection of the United States National Museum. The male has been selected by Caudell and Hebard as the lectotype.[27]

General Characters.—The subspecies *kunzei* occupies a very extensive area, and it is doubtless a virile and dominant stock, of far-reaching influence, evidence of its features being found well within territory far removed from its major areal center, and in a dilute or intermediate condition distinctly penetrating what might be considered more normal ranges for *L. c. coquilletti* and *L. c. cantator*. Whether it represents the primitive stock of the species cannot, of course, be determined, but it is the subspecies of widest distribution, even disregarding its unknown Mexican range, which is doubtless considerable.

In structure *kunzei* represents the opposite extreme from *cantator*, its size the largest, its general form the most elongate in the species complex, its fastigium the broadest and bluntest, the fastigio-facial angle in profile the most rounded with the fastigial line the most declivent. The form of the fastigium is very broad, the lateral arms of the angulation roundly obtuse-angulate in relation to each other, the whole less protuberant and

[27] Proc. Acad. Nat. Sci. Phila., 1912, p. 160, (1912).

evident than in the other subspecies. The scutellum of the fastigium is very broad, the length from narrowest point of vertex between the eyes tothe apex of the fastigium faintly (male) to decidedly (female) less than the breadth of the same. In profile the fastigio-facial angle is much more broadly rounded and less protuberant than in the other subspecies, the fastigial line markedly arcuate declivent.

Morphological Notes.—The general angle of the lateral sections of the fastigial outline, when taken in relation to one another and including the ventral lateral foveolar margins, in comprehensive view from the dorsum, varies in the male sex from a degree but slightly more obtuse than a right angle (about 100°), a relatively uncommon condition, to one with these sections forming a broadly obtuse angulation (approximately 130°) in relation to one another; in the female sex the relation of these sections to one another ranges from but slightly obtuse (about 95°) to much broader obtuse (about 120°). The scutellum of the fastigium averages appreciably broader than in the other races, but shows a marked range of variation, with one of its extremes essentially as in *L. c. coquilletti*, although the general fastigial form and the rounded fastigio-facial angle will enable one to properly place the material. In the male sex the scutellum ranges from slightly longer than broad (using the points for proportions as on pages 63–64), a relatively rare condition, to slightly broader than long, which is the more usual type; in the female, the proportions range from very slightly longer than broad to decidedly shorter than its breadth. The fastigio-facial angle is always well rounded, but little protuberant in typical material of *kunzei*, although there is some variation in the exact degree of the slope of the fastigial line and consequently the angulation itself, which is always rounded.

Bullation of the metazona of the pronotum is not a frequent condition in typical material of *kunzei*, being noticed in but thirteen specimens of the large series before us, and in these but two have it strongly indicated. Atypical material shows the bullate condition is somewhat more frequent than in typical *kunzei*. The tegmina vary in length in proportion to that of the body as in the other subspecies, as is clearly illustrated by two males of the Sentinel, Arizona series having approximately the same body bulk, in one of which the apices of the tegmina surpass the femoral apices by 3.6 mm., in the other by 5.3.

The number of transverse nervures of the marginal field of the male tegmina varies from fifteen to twenty-three, both extremes being found in the large Sentinel series. A difference of as much as three has been found between the two tegmina of one insect, although in the majority of individuals the two agree or show a difference of but one.

The number of spines on the external margin of the caudal tibiae varies from nine to eleven, with ten the usual quantity present. The extremes are to be found in the Kingman and Sentinel series.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
Typical *L. coquilletii kunzei*					
Five miles west of Coyote Wells, California	14.8	2.9	2.3	13	8.2
Five miles west of Coyote Wells, California	15.7	3.3	2.5	15.5	9
Mammoth Tank, California	17.8	—	2.8	16.5	9.8
Yuma, Arizona	16.8	3.5	2.7	16	10
Yuma, Arizona	16.8	3.5	2.6	17.4	9.9
Sentinel, Arizona	15.8	3.3	2.5	15	9.4
Sentinel, Arizona	19	3.5	2.8	16.8	9.8
Quitobaquita Hills, Arizona	16.2	3.2	2.4	15.4	9
Quitobaquita Hills, Arizona	17.2	3.5	2.6	17.2	9.5
Maricopa, Arizona	15.8	3.1	2.4	15.5	9
Maricopa, Arizona	18	3.8	2.8	18.2	9.7
Santa Cruz Village, Arizona	16.3	3.5	2.5	16.6	9.5
Santa Cruz Village, Arizona	18.2	3.6	2.6	17.9	10
Roebles Pass, Arizona	16.5	3.5	2.6	15.2	9.5
Roebles Pass, Arizona	17.2	3.5	2.7	17	9.3
Tucson, Arizona	18	3.3	2.5	16.9	9.7
Atypical *L. coquilletti kunzei*					
Kane Spring, California	17.3	3.5	2.5	17.2	9.7
Goffs, California	13.7	2.9	2.2	13.8	7.9
Goffs, California	15.2	3.2	2.5	15	8.5
Needles, California	15	3.	2.4	13.6	8.6
Needles, California	16.6	3.4	2.7	16.5	9.2

	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of caudal femur
♀	Typical *L. coquilletti kunzei*				
Five miles west of Coyote Wells, California	22	4.2	3.2	19.2	10.5
Five miles west of Coyote Wells, California	23.2	4.5	3.4	20.6	11.5
Mammoth Tank, California	25.5	4.9	3.6	21+	12
Yuma, Arizona	22.2	4.3	3.5	21	12
Yuma, Arizona	26	4.8	3.4	23	12.5
Sentinel, Arizona	20	4	2.8	17.6	10
Sentinel, Arizona	26	4.6	3.3	21.2	12
Growler Pass, Arizona	26.5	4.6	3.4	22.5	12
Quitobaquita Hills, Arizona	22.6	3.9	3	20	10.5
Maricopa, Arizona	23	4.5	3.4	21.5	11.8
Santa Cruz Village, Arizona	21.4	3.9	3.1	19	11
Santa Cruz Village, Arizona	25.5	4.6	3.4	22.2	12.2
Roebles Pass, Arizona	23.2	4.2	3.2	21.5	12
Tucson, Arizona	22.6	4.4	3.2	20.8	11
Tucson, Arizona	25.2	5	4	23.7	13.2
	Atypical *L. coquilletti kunzei*				
North of Indio, California	22.5	4.2	3.2	18.8	11.5
Oasis, California	24	4.5	3.4	20.5	11.8
Oasis, California	24.6	4.8	3.6	21.5	12.2
Goffs, California	20	3.9	2.9	17.7	9.3
Goffs, California	21.5	4	2.7	19	10.5
Needles, California	22.5	4	3.3	18.8	10.8
Needles, California	23.4	4.6	3.3	20.6	12.1
Yucca, Arizona	22.2	3.9	2.9	18.1	10.5

It is evident from the above measurements that *L. c. kunzei* has the greatest average size of the three subspecies. The maximum size is apparently in response to conditions at present unknown, being more prevalent at localities of relatively low elevation, although this is by no means a rule, as at the eastern limit of the subspecies (and species), about Tucson, Arizona, where the general elevation is considerable for *L. coquilletti*, the size is large. The great size of individuals from the lower levels of the Colorado and Mohave Deserts is noteworthy, also

evident in Bagdad material intermediate between *L. c. coquilletti* and *L. c. kunzei* (see pages 77–78).

Color Notes.—While much local and individual variation in color tone and pattern is indicated, the present subspecies frequently shows a more brilliant coloration than either of the other geographic races of the species. The overlying "pepper and salt" punctulate pattern is frequently more evident in this form, particularly in the female sex, individuals from Kingman and Santa Cruz Village, Arizona, quite distant localities, having this particularly marked. On the other hand the large Sentinel series is relatively dull and somber, while the male sex from a number of localities shows little contrast. The femoral bars are usually well indicated on the dorsal surface, less frequently on the external surface as well, and then almost always in the darker individuals.

The general base color ranges in the male from light drab (as a wash of the dorsal aspect), light ochraceous-buff, with warm buff on the caudal femora, to generally warm buff and finally a general bister tone. The female ranges from pale ochraceous-salmon, through pronounced hazel with the tegmina heavily fusco-punctulate and the caudal femora nearly hazel in base color, to bister. Rarely the female is pale bister brushed with pale ecru-drab, producing a remarkable ashen appearance. The intensity and density of tegminal punctulation, of course, appreciably modifies the general appearance of the insect.

The Yuma series is largely very pale, some of the females the palest of the subspecies seen by us. The large Sentinel representation is dull and somber, as would be expected of its environment, while the Santa Cruz Village series is the darkest and the most decidedly reddish (hazel) of any. The small Kingman lot is contrastingly colored, while the small lots from Colorado Desert localities are quite grayish, the Kane Spring male being the exceedingly pale light drab individual mentioned above. Goffs and Needles individuals of both sexes are frequently, but not generally, of sharply contrasted coloration, the femoral bars, dark lateral pronotal blotches and dark pleura being relieved from the buffy pale base tone.

The black collar patches on the sides of the pronotum are present in a number of specimens, of both typical and atypical *kunzei*. These are, as usual, more evident in the male. One male from west of Coyote Wells, California; one from Kingman, two males and one female from Yuma and one male from Sentinel, Arizona have these markings pronounced, while we find distinct traces in one male and one female from Kingman, and one male and four females from Sentinel. In the atypical material we find one male, three females and one immature from Needles and two males from Goffs, California, with conspicuous dark lateral pronotal blotches.

The eyes range from ochraceous-buff and buckthorn brown, with mottlings of prout's brown or mummy brown, through ochraceous-tawny, mottled with darker, to cinnamon-brown and dresden brown mottled with prout's brown. The caudal tibiae show a variable base color, weakest proximad, generally mottled with brownish, which distad is occasionally nearly solid and often pencils the carinae. The tibial base color ranges from naples yellow through mustard yellow to pale honey yellow, to lavender gray, vinaceous-lavender, light drab, and in the extreme condition purple drab. The Sentinel series alone shows a very considerable portion of this color range.

Distribution.—Over the whole of the Gila Desert of Arizona, eastward to the country about Tucson, and probably northward to the base of the main uplift of the Arizona Plateau, *kunzei* is found, while westward its range sweeps over the Colorado Desert of southeastern California to the lower slopes of the eastern escarpment of the San Diegan Coast Range, in an atypical form reaching as far northward as Goffs and Needles, California and Yucca, Arizona. As we have pointed out in our discussions of the distribution of the other subspecies, *kunzei* intergrades with true *coquilletti* in California in a narrow belt along the relatively higher slopes of the eastern escarpment of the San Diegan Coast Range; to the northward in the Panamint Valley and at Searles Borax Lake, in the northeastern portion of the Mohave Desert on the hills north of Kelso, as well as along the course of the Amargosa River at Shoshone, similar intermediates are found. We have discussed under the specific treatment the inter-relation of the three subspecies in

the Mohave-Amargosa region, as well as the probable explanation for the peculiar features of their distribution in that territory (see pages 61 and 62). In the east-central Mohave Desert we find *kunzei* and *coquilletti* intergrading at Bagdad, in the Cadiz-Amboy depression. In the Imperial Valley the material is typical, but the extreme penetration of the Salton section of the Colorado Desert by *kunzei*, as at Kane Spring, Oasis and Indio, shows a slight departure from the typical *kunzei* of the remainder of the Colorado Desert and eastward in Arizona.

In vertical distribution typical *kunzei* ranges from 145 feet (Yuma) to 3300 feet (Santa Cruz) above sea-level, although atypical *kunzei*, along the western border of its distribution in the Salton depression, occurs down to at least 186 feet below sea-level (Oasis). We have treated elsewhere (see pages 72 and 80) the vertical distribution of intermediates between *kunzei* and the other subspecies. Exclusive of south-central Arizona, we have no records of typical *kunzei* from above 1500 feet, although atypical material was taken at Goffs, California, at an elevation of 2584 to 3100 feet. In south-central Arizona, howver, the distribution of *kunzei*, and incidentally of *Ligurotettix*, extends over Papagueria, southwest of Tucson, reaching elevations of 2400 to 3300 feet in the general eastward rise of the country toward the Continental Divide. From east of Tucson we have no records of the genus, and from our own field experience in that territory we question its occurrence. General elevation of base level and lack of suitable environment are probably the factors responsible for its limitation in this direction.

Biological Notes.—As we have stated under *L. c. coquilletti*, the present subspecies is equally partial to creosote bush (*Covillea tridentata*), which is found over by far the greater part of the territory occupied by *kunzei*. In certain localities (Sentinel, Roebles Ranch and Roebles Pass) it was found by us in mesquite-trees (*Prosopis* species) and once (Santa Cruz, Comobabi Mountains) in iron-wood (*Olneya tesota*), while it occasionally frequents other shrubs. Its preference for *Covillea*, however, is very marked, even when this, as at Sentinel, Arizona, is parched and brown, struggling for existence in a desolate lava strewn sand plain, where a thriving *Ligurotettix* population was quite at home. As Rehn and Hebard have already pointed out[27] the

[27] Proc. Acad. Nat. Sci. Phila., 1908, p. 385, (1908).

stridulating of *kunzei* is faint, and may be represented by sikk, sikk, sik-sik-sik, which is repeated at frequent intervals, one male answering another. On bright days the insect is more active and stridulates more frequently and generally than on cloudy or cool days. Even at mid-day on cloudy days it will refrain from performing, but as soon as the clouds drift away and the air is shimmering again with the desert heat, *Ligurotettix* will resume the interrupted concert.

The earliest date for *L. c. kunzei* we have represented by material is July 1 (Florence, Arizona), from which time on we have evidence of its occurrence until at least as late as October 12 (Tucson). How far beyond that date the species lives is questionable, although we feel certain that in the Tucson region it is nearing the end of its season at the date given above. How low a temperature this species will stand remains to be determined, but by the middle of October the nights are very cool in that part of Arizona. Frost may occur in the Tucson district by late November. At points of much lower elevation in western Arizona and southern California, where the sum total of annual temperature is higher, doubtless *kunzei* has a far longer life period. Immature females are before us from Roebles Ranch, Arizona, and Needles, California, the former taken July 25, the latter August 3 to 4, all of these being in the instar preceeding maturity, and taken in company with adults of both sexes.

Specimens Examined: 213; 120 ♂, 87 ♀, 6 immat. ♀.

Typical *L. coquilletti kunzei*

CALIFORNIA: Five miles west of Coyote Wells, eastern slope of Coast Range, Imperial County, about 500 feet, IX, 16, 1922, (R. & H.; locally and in small numbers in creosote bush), 3 ♂, 2 ♀. Mammoth Tank, Imperial County, 260 feet, (Leon La Forge), 1 ♂, 1 ♀, [Hebard Cln.].

ARIZONA: Yuma, Yuma County, 145 feet, VII, 27, 1907, (R. & H.; in creosote bush, extremely active and wary), 3 ♂, 7 ♀:[28] X, 1, 1910, (R. & H.; locally common in creosote bushes), 7 ♂, 4 ♀. Sentinel, Maricopa County, VII, 27, 1907, (R. & H.), 1 ♂, [Hebard Cln.]:[28] 686-750 feet, X, 2 1910, (R. & H.; common and widely distributed in poor creosote bushes on lava strewn sand plain), 44 ♂, 20 ♀. Growler Pass, Growler Mountains, IX, 19, 1922, (R. & H.; common), 2 ♀. Quitobaquita Hills, Pima County, 1100–1375 feet, IX, 19, 1922, (R. & H.; common in creosote bushes and other desert shrubs), 4 ♂, 1 ♀.

[28] Recorded by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1908, p. 384, (1908).

Maricopa, Pinal County, 1172 feet, X, 3, 1910, (R. & H.; widely distributed in desert brush and occasionally in mesquite), 8 ♂, 1 ♀. Florence, Pinal County, 1493 feet, VII, 1, (Biederman), 1 ♂, [A. N. S. P.].[29] Santa Cruz Village, west side of South Comobabi Mountains, Pima County, 3100–3300 feet, VIII, 10–12, 1916, (Lutz and Rehn; common on creosote bush, also noticed and collected on iron-wood), 10 ♂, 24 ♀, [A. M. N. H. and A. N. S. P.]. Roebles Ranch, Avra Valley, Pima County, 2700 feet, VII, 25, 1907, (R. & H.; chiefly on mesquite), 7 ♂, 1 ♀, 1 immature ♀, [A. N. S. P. and Hebard Cln.].[30] Snyder's Hill, Avra Valley, Pima County, X, 11, 1910, (R. & H.; few in creosote bush), 2 ♂. Roebles Pass, Tucson Mountains, Pima County, VII, 25, 1907, (R. & H.; chiefly on mesquite), 11 ♂, 4 ♀, [Hebard Cln. and A. N. S. P.][31] Tumamoc Hill, Tucson, Pima County, 2400–3092 feet, X, 3–4, 1910, (R. & H.; scarce on creosote bushes), 3 ♂. Tucson, Pima County, 2400 feet, VII, 26, 1907, (R. & H.), 2 ♂, 2 ♀[32]; X, 12, 1910, (R. & H.; very few in creosote bushes), 3 ♂, 2 ♀.

Atypical *L. coquilletti kunzei*

California: Hills north of Indio, Riverside County, sea-level to 50 feet above, IX, 17, 1922, (R. & H.; few in creosote bush on flat), 1 ♀. Oasis, Salton Basin, Riverside County, 186 feet below sea-level, IX, 17, 1922, (R. & H.; in moderate numbers in creosote bush and other desert brush), 3 ♀. Kane Spring, Salton Basin, Imperial County, 75 feet below sea-level, IX 17, 1922, (R. & H.; scarce in few creosote bushes near spring), 1 ♂. Goffs, San Bernardino County, 2584–3100 feet, VIII, 5, 1919, (R. & H.; common in creosote bushes), 4 ♂, 3 ♀. Needles, San Bernardino County, 550–750 feet, VIII, 3–4, 1922, (R. & H.; common in creosote and other bushes), 5 ♂, 8 ♀, 5 immature ♀.

Arizona: Yucca, Mohave County, 1804 feet, VIII, 4, 1920, (O. C. Poling), 1 ♀, [Hebard Cln.].

Intermediates between *L. coquilletti cantator*, *L. coquilletti coquilletti* and *L. coquilletti kunzei*

See page 74.

[29] Recorded by Rehn, Proc. Acad. Nat. Sci. Phila., 1904, p. 563, (1904).

[30] Recorded by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1908, p. 384, (1908).

[31] This is the material recorded by Rehn and Hebard (Proc. Acad. Nat. Sci. Phila., 1908, p. 384, (1908)) as from "Sonora Road Canyon".

[32] Recorded by Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1908, p. 384, (1908).

Explanation of Figures

Plate VI

Fig. 1.—*Goniatron planum* Bruner. Male. Sierra Blanca, Texas. Dorsal view. (× 2.)

Fig. 2.—*Goniatron planum* Bruner. Male. Sierra Blanca, Texas. Dorsal outline of head and pronotum. (× 3.)

Fig. 3.—*Goniatron planum* Bruner. Male. Sierra Blanca, Texas. Cephalic view of head. (× 3.)

Fig. 4.—*Goniatron planum* Bruner. Male. Sierra Blanca, Texas. Ventral surface of tegmen to show thickening and elevation of discoidal vein. (Greatly enlarged.)

Fig. 5.—*Ligurotettix coquilletti kunzei* Caudell. Male. Needles, California. Dorsal view. (× 3.)

Fig. 6.—*Ligurotettix coquilletti kunzei* Caudell. Male. Maricopa, Arizona. Cephalic view of head. (× 4½.)

Fig. 7.—*Ligurotettix coquilletti kunzei* Caudell. Male. Needles, California. Ventral surface of tegmen to show thickening and elevation of discoidal vein. (Greatly enlarged.)

Fig. 8.—*Ligurotettix coquilletti cantator* new subspecies. Male (*type*). Mason, Nevada. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 9.—*Ligurotettix coquilletti cantator* new subspecies. Male (*type*). Mason, Nevada. Outline of fastigio-facial angle in profile. (Greatly enlarged.)

Fig. 10.—*Ligurotettix coquilletti coquilletti* McNeill. Male. Acton, California. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 11.—*Ligurotettix coquilletti coquilletti* McNeill. Male. Acton, California. Outline of fastigio-facial angle in profile. (Greatly enlarged.)

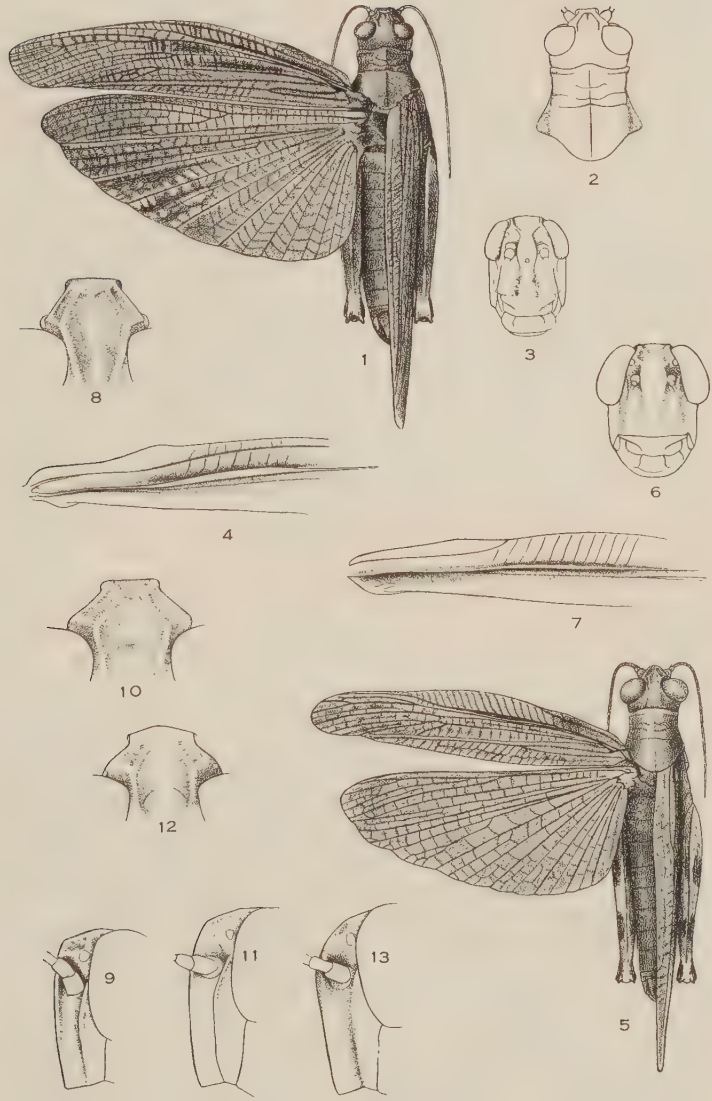
Fig. 12.—*Ligurotettix coquilletti kunzei* Caudell. Male. Maricopa, Arizona. Dorsal view of fastigium. (Greatly enlarged.)

Fig. 13.—*Ligurotettix coquilletti kunzei* Caudell. Male. Maricopa, Arizona. Outline of fastigio-facial angle in profile. (Greatly enlarged.)

Plate VII

Fig. 1.—Typical habitat of *Goniatron planum*. Along Boquillas-Marathon Road. Miravillas Creek, Brewster County, Texas. (Photograph by Hebard and Rehn.)

Fig. 2.—Typical habitat by *Ligurotettix coquilletti cantator*. Lower slopes of Singatse Range at Mason, Nevada. (Photograph by Hebard and Rehn.)



REHN—LIGUROTETTIGI

Fig. 1.—Typical habitat of *Goniatron planum*. Along Boquillas-Marathon Road, Miravillas Creek, Brewster County, Texas. (Photograph by Hebard and Rehn.)

Fig. 2.—Typical habitat by *Ligurotettix coquilletti cantator*. Lower slopes of Singatse Range at Mason, Nevada. (Photograph by Hebard and Rehn.)

MAYFLIES FROM COLORADO

DESCRIPTIONS OF CERTAIN SPECIES AND NOTES ON OTHERS

BY G. S. DODDS

West Virginia University

The mayflies described herewith were collected in Boulder and Gilpin Counties, Colorado, chiefly along the valley of South Boulder Creek from its head waters just below the Continental Divide, at eleven thousand feet or above, and eastward in the valley to the edge of the Great Plains, at about five thousand, five hundred feet.

The material covers three summers of collecting and ecological study of mayflies and other aquatic insects of that region, and an additional summer spent chiefly in determining life histories by rearing nymphs in cages. Much work during these summers was done by F. L. Hisaw, now of the Department of Zoology of Kansas Agricultural College, who was constantly associated with me in the ecological work.

Some of the species have been determined for me by Dr. J. G. Needham, to whom thanks are due. Others are doubtless new species, while of still other species it is difficult to tell whether they fit existing descriptions. A goodly number of the Colorado and other western species have been described by Eaton, from collections made by the Hayden Survey and other early naturalists, since which time hardly anything has been added. The nymphs in that region have been almost unstudied.

The list includes twenty-seven species, thirteen of which are known by both nymphs and imagos, twenty-four by imagos alone, and seventeen by nymphs only. Nine of these species have previously been described, fifteen are probably new and are described here. The thirteen life-histories were determined by rearing nymphs in cages.

Specific characters of mayfly imagos have so far not been satisfactorily defined. Eaton in his large work has made use almost wholly of coloration, as have most of the early workers. This has the disadvantage that most people do not know the

colors used, that they change more or less in dead specimens, that there is considerable variation, and that in alcoholic specimens they are lost, even the pattern of dark and light areas being considerably obscured after a time. For so small and fragile insects as mayflies alcoholic preservation is more practical than dry, and has the further advantage of less distortion of chitinous parts such as legs, genitals, etc., and for nymphs it is the only practical way.

The characters used in describing species should be, if possible, such that they can be recognized in either living, dried, or alcoholic specimens. I make no claim that my descriptions meet these requirements. I have merely tried to define the species found during my ecological work in such a way that they may be recognized by future students, and believe that, with the possible exception of some of the species of the genus *Baetis*, I have accomplished this. The whole subject, however, is in great need of thorough revision by one who can devote much time to it.

Needham has made use of the male genitals, which seems a good feature but has the disadvantage of inapplicability to both sexes. In determining species I have been unable to be sure of my alcoholic specimens as compared with descriptions based on colors of dried ones. Accordingly I have included notes and figures of known species as well as of new ones, in an attempt to make it possible for future students to know definitely what species I have had. I have not tried to make full descriptions, but rather to select those features which are of service in recognizing forms. For the imago I have mainly used, length of body and cerci, length of fore and hind wing, venation in some cases, conspicuous coloration such as plain color pattern (light and dark areas which persist in alcohol), the male genitals and in some cases the female sub-anal plate. The male genitals appear to be quite specific and easily studied, and together with the size and general coloration, will usually serve to identify both male and female from a given locality. I have not tried to define sub-imagos. For the nymph, no one set of characters can be used for all species because of the adaptational variation of the nymphs. Each genus has its own set of specific character-

istics. In these immature stages there is the added difficulty of differences produced by age and the phase of the molting cycle.

Types of the new species described in this paper are to be found in the Academy of Natural Sciences of Philadelphia, as well as examples of most of the other species mentioned in the report.

DRUNELLA

This genus, separated by Needham from *Ephemerella* to accomodate *E. grandis* Eaton and his nymph, "Nameless ally of Ephemerella, No. 2," has appeared in my collections. It includes Eaton's nymph No. 2 and No. 3 and the imago from nymph No. 3.[1] These two nymphs are clearly related to *Ephemerella* on account of certain characters, but in other respects are so different from each other that one would hesitate to assign them to the same genus.

Drunella grandis (Eaton) (Figs. 1 and 2.)

Imago. Imagos of both sexes were easily reared from nymphs, between July 27 and August 11. This is the largest imago in my collections, and though the nymphs are abundant, only one imago has appeared in my series. The following notes, based upon my observations, may serve definitely to identify this interesting species for future collectors.

Length, 15 mm. Cerci, three, 12 mm. Fore wing, 15-17 mm. Hind wing, 3.5 mm. In the fore wing the venation is as in *Ephemerella* except that cu_2 arises from A_1 (fig. 1), instead of from an anastomosing vein as in *Ephemerella* (fig. 3). This is the character upon which Needham established the genus.[2]

Coloration (alcoholic). Thorax about uniform brown. Abdomen appears dark when strongly contracted, but at ordinary extension is ringed, showing each segment with a brown band and a light edge. Each dark ring has a light spot like an inverted "J" above the spiracle, with the hook directed caudad, and a small dorso-ventrally elongated light fleck on each somite just below the pleural line. There is also a pair of light spots near the mid-ventral line. This pattern is more prominent on the anterior than on the posterior segments.

[1] A. E. Eaton, A Revisional Monograph of Recent Ephemeridae or Mayflies. Trans. Linn. Soc. London, 2nd Series, Zoology, 1883–1888.

[2] J. G. Needham, N. Y. State Museum, Bull. 86, pp. 42–43, (1905).

Pleura of ninth abdominal segment with a prominent acute angle at caudal end, and eighth with a rounded suggestion of this angle. Male subgenital plate has a low rounded extension between the bases of forceps. Forceps, three-jointed: first, short, cylindrical; second, long, curved, inner surface closely tuberculate and sharply concave at its middle, the outer margin is convex throughout, but more sharply curved at about two-thirds of its length; third segment about two-fifths as long as second, of about uniform thickness, concave and tuberculated on the inner surface. Penes united nearly to tip and curved dorsad, with sharp V-shaped notch at tip, bringing openings of the two sperm ducts close together (fig. 2).

There seems little question but this species is the same as *Ephemerella grandis* Eaton, based upon specimens from Colorado and the Yellowstone. His description is based largely upon the coloration of dried females, which he said could not be wholly trusted, and males are wanting. Thus, we have little more than agreement of wing characters, size and locality, by which to judge identity.

Nymph. This is the striking nymph described by Eaton in his Monograph under the heading "*Nameless nymph allied to Ephemerella, No. 3,*" and figured in plate 39. The locality given is, "Colorado, in a brook at Idaho (Idaho Springs?) adhering to the under side of a board, 5th of July; Roaring Water Fork, Colo., 2nd Aug., Lt. Wheeler."

I have found it very commonly in swift streams, both small brooks and good sized creeks in South Boulder Canyon, at elevations between six thousand, seven hundred and ten thousand, five hundred and eighty feet. It lives among rocks and coarse gravel of stream beds, but neither on the surface of rocks exposed to great force of water or among shifting gravel.

Eaton's description is full and accurate and leaves no doubt as to the identity of the nymph. Only a few additional notes are desirable. This is by far the largest nymph in the region where it occurs. The common length of the nature nymph is 13 mm., with a thorax 4.5 mm. wide and of considerable dorso-ventral thickness. Its most striking feature is the setose sucking pad with which the ventral side of the abdomen is provided. The sterna of segments two to nine are densely hairy, especially at the lateral margin, making of the eight sterna involved an oval

sucking disc quite different from the sucker of some other nymphs composed of overlapping gill lamellae. This is really an adhesive organ of considerable power, as shown by the strength with which living nymphs adhere to rocks or aquaria.

Drunella species

Nymph. Length, 13 mm. I have collected this nymph in South Boulder Creek, Colorado from 5,900 to 8,500 feet. A very similar nymph is described by Eaton as "*Nameless nymph allied to Ephemerella, No. 2,*" and figured in Plate 38, from Klikitat Valley, Washington. Needham finds material from Colorado and New Mexico differs slightly from Eaton's figures of the type material from Washington. The difference seems to be in the tubercles of the thorax, in which respect my observations agree with Needham's figures. My material differs from both, however, in that the dorsal abdominal spines occur in regularly increasing series on segments two to nine, instead of being nearly equal throughout, as in the drawings of Eaton and Needham. It is quite probable that Needham's nymphs belong to the same species as mine, and that Eaton's slightly different material from Washington may represent a different species.

Needham has spread the wings of specimens from New Mexico, and on this evidence assigned the nymph to the genus *Drunella*, and further indicates the probability that this is the nymph of *Ephemerella grandis* Eaton. I have not reared the nymph, but since imagos from a different nymph agree so far as can be determined, with *Ephemerella grandis*, I prefer to apply the name to that nymph rather than to this one. The large size of both imago and nymph to which I have applied the name, and the somewhat smaller size of this one, are about the only bits of evidence for my use of the name, inasmuch as I cannot positively identify my imagos by Eaton's description.

EPHEMERELLA

Ephemerella coloradensis new species (Figs. 3 and 4.)

Imago. Imagos were reared in abundance from nymphs, taken at 9,300 feet, during the last week of July, but imagos of this species have not appeared in my general collections of mayflies from this region.

♂. Length, 12 mm. Fore-wing, 12 mm., typical for the genus (fig. 3). Hind wing, 3.5 mm. Cerci, three, a little longer than the body.

Male sub-genital plate about straight across between the bases of the forceps (fig. 4). Forceps three-jointed; first joint short; second joint more than three times as long as first, moderately and uniformly curved, and thinner about the middle than at the ends, tuberculate on inner surface; third joint about equal to first, slender, slightly expanded distally, and tuberculate on inner surface. Penes united and expanded distally, with only a low indentation between them at the tip, sperm ducts open far apart and each bears a dilatation just before end. Ninth pleura has slight point at posterior angle, others without angles except in strong contraction when slight points show on others.

Coloration (alcoholic). No striking marks: Thorax dark brown, abdomen about uniform dark brown, except for light pleural stripe and light bands between segments when body is extended.

Type.—♂; reared from nymph, Tolland, Colorado, July, 1921.

Allotype.—♀. Same locality as ♂.

Description of male holds except for special sexual structures.

Nymph. A common form in South Boulder Creek and tributaries, 6,700 to 9,500 feet.

Length, 11 mm. Head with face vertical and flattened in front between the lateral eyes. Face and top of the head made rough by numerous low knobs. Thorax stout. Abdomen with small flat pleural expansions, each with a posterior angle, hardly noticeable on the anterior segments and increasing posteriorly, but never becoming prominent except on the ninth segment. Each segment bears on the dorsal posterior margin a a pair of small, acute tubercles, directed caudad and somewhat larger on the posterior than on the anterior segments. Legs stout, femur somewhat flattened, posterior margin with a few spines and many hairs, anterior margin of the first femur with several tubercles, each bearing spines on its tip. Tibia with thumb-like end, claw short and curved with a few short teeth. Gills on third to seventh abdominal somites, of the usual type for *Ephemerella*. Cerci, three, about as long as the abdomen, each with two light and two dark color bands.

Coloration (alcoholic). Light brown with light areas. Whole animal has a mottled appearance due to bands on legs and cerci, certain irregular markings on body, and pattern of gill covers.

Description based on a nymph from Tolland, Colorado, July 1921.

Ephemerella nymph no. 1.

Though attempts to rear this nymph have been unsuccessful, and its imago is consequently unknown, it seems desirable to describe it, on account of its importance in the mayfly fauna of streams in this region. It was collected from South Boulder Creek at the edge of the stream among roots, at 9,000 feet. About thirty nymphs of this species in our collections include no males.

Length, 7 mm. Head rounded, prothorax and mesothorax in mature nymphs long, and with no special features. Abdomen broadest at about the fourth segment; segments with small pleural expansions, each with a small posterior angle growing slightly larger caudad. These flat margins bear a row of club shaped spines. Each segment bears on the dorsal posterior margin a pair of acute tubercles, larger on the middle segments. Legs fairly stout, with femur somewhat flattened, each with a row of curved spines bearing blunt points on posterior margin. The first femur with a few similar spines of larger size on anterior edge also. Tibia without thumb; claw slender, curved, with about ten short spines on the concave side. Gills typical for the genus.

Coloration (alcoholic). Legs banded, especially plain on the tibia and tarsus. Body with no prominent markings except a light longitudinal mid-dorsal stripe between the abdominal tubercles, the conspicuous mark of the nymph, but more prominent in living than in alcoholic specimens. Ventral surface of each abdominal segment has a pair of elongated dark flecks, about midway between mid-line and pleura.

Ephemerella nymph no. 2.

This nymph is common in South Boulder Creek and its tributaries, at 8,000 to 9,000 feet, and though its imago is unknown, it seems desirable to describe the nymph.

Length, 9 mm. The nymph is characterized by the broadly expanded edges of the abdominal segments, each forming a broad lamella with a prominent angle at its posterior end, largest on the eighth segment. The edge of this lamella bears a row of blunt spines. Legs moderately stout. Femur somewhat flattened, with the usual armament of spines. Claw slender, somewhat curved, and bearing about ten blunt spines.

Coloration (alcoholic). Head, thorax, abdomen and legs well pigmented, with liberal light areas, giving a mottled appearance. Cerci with about ten alternating light and dark bands.

Described from a nymph from Tolland, Colorado, July, 1921.

CALLIBAETIS

Callibaetis fusca new species (Figs. 5 and 6.)

Imagos of both sexes were collected in abundance during late June and July, at 8,200 to 9,500 feet, in South Boulder Valley.

♂. Length, 8 mm. Cerci, 16 mm. Fore-wing, 10 mm., with liberal pigmented areas at front margin as far back as radius; cross-veins all along the costal space. Hind-wing, 2 mm., with numerous cross-veins, and pigmentation at base, as far as humeral prominence (fig. 6). Male forceps three-jointed (fig. 5): first stout and slightly tapering; second long, curved, thinner at middle than at ends; third the shortest, its greatest thickness a little less than half its width, its distal half with a swelling on inner surface.

Coloration (alcoholic). Thorax brown with light areas, some of which are marked with dark stippling. Abdomen with a light ground color and dark stippling, about equally dense on all segments; a pair of larger spots near mid-ventral line on each segment; a dark stripe along pleural line, and certain irregular light and dark areas on dorsal surface. Femora of second and third legs are plainly banded, the first less distinctly so.

Type.—♂; Tolland, Colorado, July, 1915.

Allotype.—♀, from same collection as type.

Description of male holds except for special sex differences common to the genus.

Nymph. This species is very common in Park and Teller Lakes in South Boulder Valley at about 9,000 feet, where it is at home on dirty portions of the bottom.

Length, 12 mm. Cerci, 3, about half the length of the body, with hairs well developed forming a good swimming organ. Head large and rounded in front; thorax moderately stout; abdomen long, with the edges of segments somewhat expanded and bearing a small point at posterior angle; legs slender, claws nearly straight with a comb of twenty-five slender teeth increasing in length and steeply inclined toward tip. Gill lamellae on segments one to seven with large and small lobe and on one and two an additional smaller lamella under the larger one.

Described from a nymph from Tolland, Colorado, July, 1915.

Callibaetis vitrea new species (Figs. 7 and 8.)

Imago. This species is represented by one specimen, collected at about 11,000 feet.

♂. Length, 6.5 mm. Cerci, 13 mm., with short, unsegmented stub of the middle one. Fore-wing, 6.3 mm., without pigmented areas. Cross-veins throughout the wing are few, and in only

distal half of costal space. Hind wing, 1.5 mm., without pigmented areas. Has three longitudinal veins, a few vestigeal cross-veins and one free intercalary (fig. 8). Forceps three-jointed: first short, tapering, with spinose pad at inner distal angle; second long, curved, thinner at the middle, basal fourth with definite wrinkles on inner side; third thicker in its distal half, its greatest thickness at about one-half its length (fig. 7).

Coloration (alcoholic). Thorax light brown, with light areas at sutures of plates. Abdomen: dorsal surface light gray-brown except on segments seven to ten, which are red-brown; ventral surface light, with dark stippling growing less dense caudally to sixth or seventh, beyond which there is none. Also one pair of dark flecks on ventral surface of each segment.

Type.—♂; Tolland, Colorado, July, 1921.

ECDYURUS

Ecdyurus ramaleyi new species (Figs. 9 and 10.)

Imago. Imagos of both sexes were reared from nymphs in early August, and have not appeared in my general collections, in spite of the fact that the nymph is the most abundant species in streams between 8,000 and 11,000 feet.

♂. Length, 8 mm. Cerci, two, 20 mm. Fore-wing, 10 mm. Hind-wing, 4 mm. Male forceps four-jointed, slender, about uniformly tapering, except first joint which is short (fig. 9). Subgenital plate between the forceps, slightly arched. Penes not united, each with lateral expansion at the tip, and smaller lobe directly at the end, the two suggesting a pair of blunt-toed boots with the toes directed outward. Each bears a slightly curved spine on mesial surface near end.

Type.—♂; Tolland, Colorado, August, 1921.

Allotype.—♀, from same lot as type.

Description of male holds except for special sex differences. Female sub-anal plate about half as long as wide, its margin composed of two rounded lobes, separated by a shallow, rounded depression.

Nymph. The most abundant nymph of South Boulder Valley from 8,000 to 11,000 feet, where it lives among rocks on the bottoms of swift streams, clinging to the surface, among and under them, but not on the surface exposed to the direct force of the swift water. It has also been found in two lakes at high altitude.

Length, 11 mm. Cerci, three, a little longer than the body. Head and body flattened, head with expanded margin, widest at about the middle. Labrum transversely elliptical, with line of attachment about half of its greatest width. Femur short and flattened, tibia and tarsus slender, claw abruptly hooked near the end, and bearing four short teeth in a lateral position in the third quarter of its length. Gills lamelliform, with one to three small filaments at base of most of them. Lamellae large, each extending back over more than two segments.

Coloration (alcoholic). Head uniform brown. Prothorax and mesothorax about the same shade, or successively lighter. Abdomen about uniform brown on dorsal surface except that the last two segments are white, a conspicuous mark in living animals as seen in the streams. Each of the other segments one to eight is slightly lighter in the mid-dorsal line and has a pair of dorsal light spots. Ventral surface pale. Femur has a plain mark like an L with the horizontal bar short and broad (fig. 10).

Described from a nymph from Tolland, Colorado, August, 1921.

RHITHROGENA

Rhithrogena elegantula Eaton (Fig. 11.)

This species, described by Eaton and recorded by him from Arkansas Canyon, Colorado, and Arizona, has appeared in my collection from South Boulder Valley between 5,200 and 11,000 feet. Inasmuch as his description is from dried material, a few notes from alcoholic specimens should be made.

Length of body, 9 mm. Cerci about twice length of body. Fore-wing, 10 mm. The body is slender and without dark coloring except the eyes. The male sub-genital plate is slightly and evenly arched caudad between the bases of the forceps (fig. 11). Forceps four-jointed: first joint short and tapering to size of second segment; segments two, three and four of nearly uniform diameter; three and four of about equal length, their combined length equal to about half the second. Penes separate and curved outward at the ends, each somewhat expanded at tip, with two lobes of about equal length; inner margin with two spines, a distal smaller one sharply curved, and a proximal one, larger and also sharply curved near base, these latter at the level where the two penes separate. The female subgenital plate nearly semicircular; subanal plate semicircular, sometimes with a slight indentation at the end.

Nymph, unknown.

Rhitrogena robusta Needham (Fig. 12.)

Imago. Imagos of both sexes are common in South Boulder Valley, at 9,000 to 10,400 feet. The species was established by Needham from specimens sent him from this locality.

Length, 12 mm. Cerci nearly three times the length of the body. Fore-wing, 14 mm. Male penes separate, curved inwards at tip; each bears near tip two small and one long spine, all directed mesad, and a large one on outer surface, at about half length of penes (fig. 12).

Nymph. Not abundant anywhere, but found under stones in swift streams, South Boulder Creek and tributaries, 5,000 to 10,400 feet. Very sensitive to lack of oxygen, and die quickly in stagnant water. The following nymph was identified with the preceding imago by rearing in cage.

Length, 12 mm. Cerci, 10 mm. Head flattened, with expanded margins, elliptic in outline, with greatest dimension transverse, a little back of the middle. Legs stout, femur flattened, with fringe of short hairs on posterior margin, and small spines on the anterior; claws stout, curved, with two small, blunt teeth at about two-thirds of their length and a larger one at about one-third. Gills on abdominal segments one to seven, each consisting of a tracheate lamella with a tuft of filaments at its base; the first lamellae are very large, much broader than any of the others, and extend forward from the point of attachment and arch toward the median line until they touch, the widest part of the lamella being at the anterior end where they meet. Gills two to six are about alike, each with a somewhat oval outline; the seventh small and narrow and curved under the body until they nearly meet. Thus the lamellae form a sucking organ. Each lamella bears on its ventral surface a setose line dividing the gills approximately into halves, but diagonally to axis of gills, in such a position that the lines on successive gills make a nearly continuous setose line, oval in shape. Tracheae branch freely in the part of the lamella proximal to the setose line, but do not extend beyond it. Labrum rounded in outline, forming less than half a circle, and bearing a slight indentation at the mid line. Mandibles and other mouth parts seem to have nothing specifically diagnostic, being not only in form but in detail very similar to those of *Ecdyurus*. Of interest are the elaborate diatom rakes especially well developed on end of maxilla, composed of about ten combs, each with several teeth.

Coloration (alcoholic). No useful marks have been observed, but I would note that in this stream two color forms have been seen, one with dark red gills and the other with them

colorless. The latter were the ones from which this life history was determined.

The nymph here described was from Tolland, Colorado, July, 1921.

Rhitrogena hageni Eaton (Fig. 13.)

Reported by Eaton from the Sierra Nevadas at Truckee, and appearing in my collection from South Boulder Valley from 8,000 to 9,500 ft. As Eaton's figure of male genitals is from dried material, it may be well to describe the alcoholic specimens. The male subgenital plate between the bases of the forceps bears two blunt lobes. Forceps four-jointed, slender. Penes not united, round at the end, each bearing a good sized spine on outer surface near base, a saw tooth on inner surface a little farther from base and two small sets of serrations on ventral surface about midway between this and the tip (fig. 13).

LEPTOPHLEBIA

Leptophlebia pallipes Hagen (Fig. 14.)

Imagos. ♂ and ♀. Collected in South Boulder Valley, 5,800 to 10,580 ft.

The male subgenital plate bears two triangular lobes which occupy the space between the bases of the forceps (fig. 14). Forceps three-jointed; first curved mesad in distal fourth, otherwise straight; second short, much thicker at distal than proximal end; third about as long as the second, but much more slender, with swelling on inner surface a little beyond the middle; all segments of forceps bear on the inner surface, short club-shaped spines.

Nymph. Not known.

SIPHLURUS

Siphlurus occidentalis Eaton (Fig 15.)

Imago. ♂ and ♀. South Boulder Valley, 5,800 to 10,000 feet.

Length of body, 11 to 13 mm. Fore-wing, 12 to 13 mm. Male subgenital plate between the bases of the forceps consists of two very low arches. Forceps four-jointed: first short, thick, cylindrical; second, third and fourth more slender, tapering about uniformly to the tip; second long, with third and fourth successively shorter. Penes do not protrude beyond the subgenital plate and are not fused. Each consist of two parts,

(a) a finger-like, slightly curved part, at the end of which the sperm duct opens, and (b) on the ventral side of this a pointed scale, bearing on its mesial edge in first half, several small serrations, with points directed toward tip. The two parts are not recognizable without dissection (fig. 15).

Coloration (alcoholic). A conspicuous color pattern persists on the abdomen of alcoholic specimens which seem to agree with Eaton's description from dried specimens.

Nymph. Common in ponds and lakes with dirty bottoms, from 8,000 to 10,000 feet in South Boulder Valley. Swims actively or lies in the loose silt with its large gills above the silt, fanning briskly.

Length, 15 mm. Cerci, three, about two-fifths of length of body. General form of body typical for the genus. Pleural lamellae of abdomen broad, with decided angles at caudal end. Gills very large; the proximal part of ventral margin of each gill thickened and spinose.

Described from a nymph from Tolland, Colorado, July, 1921.

AMELETUS

Ameletus subnotatus Eaton

A few specimens have been found in South Boulder Valley, exact locality unknown.

Ameletus velox new species (Figs. 16 and 17.)

Imago. Imagos of both sexes have been collected in considerable numbers in South Boulder Valley, between 8,800 and 11,250 feet.

♂. Length, 12 mm. Cerci, two, longer than the body. Forewing, 13 mm. The male subgenital plate, between the bases of the forceps, has a triangular prominence on either side, between which is an indentation with a straight or slightly arched bottom (fig. 17). Forceps four-jointed; first short and somewhat thickened, second long, third and fourth successively shorter and a little more slender. Penes separate, slender, distinct, each curved mesad in terminal third.

Coloration (alcoholic). No conspicuous marks. Thorax moderately pigmented and abdomen less so.

Type.—♂; Tolland, Colorado, July, 1915.

Allotype.—♀, from same locality as type.

Description of male holds except for distinctive sex difference. Female sub-anal plate shorter than a semicircular extension,

with a small notch in the middle of the free margin. Subgenital plate truncate, hardly at all extended.

Nymph. Common in South Boulder Creek and its tributaries where water is not very swift, between 5,500 and 11,000 feet. It also lives in lakes and ponds with clean bottoms. It is a very strong swimmer, being found in swifter water than any other swimming form of this region.

The nymph agrees well in general characters with *A. ludens* Needham, the genotypic species. As pointed out by Needham[3] it resembles closely the one figured by Eaton on plate 49 of his Monograph, and referred doubtfully to *Chirotonetes.* It is to be noted that Eaton's nymphs are not fully matured, and that some of them were from New York State, and one from the foothills of Colorado. It is wholly possible that this one represents *A. subnotatus,* and the New York specimens the smaller species described by Needham.

Length, 13 mm. Cerci, three, less than one-half the length of body, stout, with long hairs, making a good swimming paddle. Head large in proportion to thorax, the appearance of size being partly due to long labrum and large mandibles. Abdomen cylindrical or sub-cylindrical, tapering, with a very slight pleural ridge, terminating posteriorly in a small but sharp spine on each segment. Legs small in porportion to body; claw without teeth. Labrum a little broader than long with slight median indentation. Mandibles and labium do not differ notably from those figured by Eaton, outer and inner canines of mandibles being of same length. The maxilla agrees except that the pectinate hooks number about twenty-five, instead of sixteen as in the species figured by Eaton and Needham. The tongue has its middle lobe trilobed (fig. 16). Gills obovate, richly tracheate; each except the first two pairs, where they are less developed, has a thickened, spinose margin and a dark stripe running diagonally from the base of the gill, about one-fourth width of the gill from dorsal margin.

The nymph described from Tolland, Colorado, July, 1921.

CYNIGMA

Cynigma mimus Eaton ? (Fig. 18.)

Imago. ♂. The male of this species has been collected just below the Continental Divide for a distance of about twenty miles, in Boulder and Gilpin counties, between 10,500 and

[3] J. G. Needham. N. Y. State Museum, Bull. 86, pp. 36 to 38.

11,650 feet. The female has not been collected. The material is questionably referred to this species; it agrees in size, the type is from Manitou, Colorado, and also the figures of genitals for *C. germinatum* and *C. par* are clearly different from ours. Nothing can be determined by comparing my alcoholic colors with Eaton's descriptions.

Length, 10 mm., 20 mm Cerci. Fore-wing, 11 mm. Hind-wing, 2.5 mm. The penes are distinct, slightly expanded at tip into two rounded lobes; each bears two spines slightly curved at the tip, the one on the outer side nearly twice as long as the one on the inner (fig. 18). In the earlier stages the spines both arise from the outer margin, are directed outward and the two lobes inward. In still younger specimens the two penes are not evident, and the four spines project radially from a common mass. Legs: third tarsus shorter than the tibia: first and second joints of tibia about equal, third and fourth successively shorter and the fifth longer than the fourth. Male, first tarsus: joints as 17: 24: 27: 22: 8.

Coloration (alcoholic). Brownish, with thorax darker than abdomen, and wing veins well pigmented.

IRON

Iron longimanus Eaton (Figs. 19 to 22.)

Imago. Both sexes of this species have been collected frequently along South Boulder Valley, from 8,800 to 10,280 feet.

Eatons' description of dried specimens from Manitou, Colorado, should be supplemented by the following notes from alcoholic specimens. Proportionate lengths of joints of male first tarsus 24: 26: 22: 17: 7, with some variation in the exact proportions, but the second is slightly longer than the first, and the third shorter than the first, though their difference is slight. The male genitals appear different in varying degrees of expansion. When fully expanded the penes are separate some distance back from the end, each partially divided into two rounded lobes, and bearing a small curved spine on the outer surface near the end and a larger one on the inner surface near the base (fig. 22). A common earlier phase shows the penes of somewhat different form and bound together by a membrane (fig. 21). This phase is evidently the one figured by Eaton in plate 65. The male subgenital plate is evenly and moderately curved. The female sub-anal plate is semicircular, with a small notch in the middle of the free margin.

Nymph. Lives among rocks on the bottom of swift streams of South Boulder Valley. Has been collected between 9,000 and

10,000 feet, but doubtless has a much wider range. Very sensitive to lack of oxygen and dies quickly in collecting vessels, but lives readily and transforms in screen cages in running water.

Length, 10 mm. Cerci, 10 mm. Has usual flattened head and body characteristic of the genus, with the head expanded at the edge and widest near the fringed front. It has the usual sucker formed by the gill lamellae, the first and seventh of which curve under the body. Each lamella has the customary tuft of filaments at its base. Special feature of gills of this species as follows: first pair of gills only moderately enlarged in front, and lack much of meeting in the mid line (fig. 19). All lamellae except the first and seventh decidedly elliptical, about the same length, but successively narrower posteriorly, the ratio of length and width changing from 3:2 to 7:4. Each has a thickened, setose, ventral margin extending nearly to the base, and just inside this, an opaque, brownish zone which extends from tip to base and a short distance from base on dorsal edge of lamella. The seventh is about the same shape as the sixth but smaller and folded, so that its tip curves under the abdomen. The first has also the setose margin, but the brownish zone of this gill is somewhat L-shaped and does not include the anterior lobe.

Coloration (alcoholic). General color effect grayish. Mesothorax has a plain pattern not wholly obscured by changes in intensity with phase of molting cycle, consisting in the main of a light, lanceolate mark, broadest in front, flanked by a pair of somewhat triangular light areas with long side inward (fig. 20). Femur has a broad light area on proximal half extending to posterior margin just short of middle of segment.

Described from a nymph from Tolland, Colorado, July, 1921.

Iron nymph no. 1. (Figs. 23 and 24.)

The following nymph (imago unknown) is found in South Boulder Creek between 9,000 and 11,000 feet, among stones in swift portions of the stream. It differs from the nymph of *Iron longimanus* as follows:

Length, 7 mm. Gill lamellae two to seven are much less elongated than those of the former species, the second being wider than long, the others successively narrower, but always proportionately wider than in *I. longimanus*. The first gill has a greatly enlarged anterior lobe, so that the right and left gills meet in the mid ventral line (fig. 23). The setose margin of gills is as in the former species, but the opaque area is wanting from the first pair, and on the others there is a space between it and the setose border.

Coloration (alcoholic). Brownish. Mesothorax generally dark, with main light areas in the form of two bands running forward and outward from mid line in caudal half of segment (fig. 24). Femur with broad light area in proximal half with expansion connecting to posterior margin just short of middle of segment, as in *I. longimanus*, with the addition of a very definite dark spot opposite, this expansion.

Described from a nymph from Tolland, Colorado, July, 1915.

Iron tollandi new species (Fig. 25.)

Imago. Collected in South Boulder Valley, 9,000 to 11,000 feet.

♂. Length of body, 8 mm. Cerci, two, 20 mm. Fore-wing, 10 mm. Hind wing, 4 mm. Relative length of joints of tarsus, 24: 31: 30: 24: 9. The distinctive features are found in the male genitals. Penes separate, each ending in two bluntly pointed lobes directed mesad. Each bears near the end a good sized spine ending in a blunt hook (fig. 25).

Coloration (alcoholic). Gold brown with no dark parts.

Type.—♂; Tolland, Colorado, July, 1915.

BAETIS

This genus is a difficult one with which to deal. The insects are small and the species hard to distinguish. Characteristics based upon coloration seem to be of no use whatever where alcoholic specimens must be used, Other characteristics must be relied upon, preferably structural differences large enough to be readily seen and not subject to great variation. Accordingly in the following notes there are described only a few points, for the imago, chief among them, size, peculiarities of hind wing and male forceps. The nymph is equally difficult, with the added uncertainty of change due to age and phase of molting cycle. Here, the characters that seem to give most useful distinctive features are size of mature nymph, number and length of cerci, size and form of gill lamellae. The color pattern persists fairly well for a while in alcohol (i. e. arrangement of light and dark areas) and has given confirming evidence. In case of both nymphs and imagos, however, there is no high degree of certainty as to the accuracy of specific lines—the group one calls a species may include more than one species or he may have divided a species by the use of variable characters.

Baetis bicaudatus new species (Figs. 26 to 28.)

Imago. Reared from nymph, 1921. Character of female as follows. Male not known.

♀. Length of body, 4.5 mm. Cerci, 9 mm. Fore-wing, 6.5 mm. Hind-wing, 0.75 mm., with prominent humeral point and two longitudinal veins arising from a common stalk just proximal to the arched vein (fig. 26). Coloration (alcoholic) uniform, light brown.

Type.— ♀; reared from nymph, Tolland, Colorado, August, 1921.

Nymph. Streams of South Boulder Valley, 9,000 to 11,000 feet. Lives in very swift water, especially earlier stages. Nymphs cling to surface of rocks over which water runs with great speed, or even where water pours upon a rock with considerable force, so that no other mayfly nymph can live there.

Length of body, 6 mm. Head and body of usual form for the genus. Legs without special features, fairly stout, femur flattened. Claw with about ten teeth increasing in length toward the tip. Gills on segments one to seven, of single lamella, with tracheae showing only faintly. Each gill covers only the base of the next gill (does not reach base of second gill even in strongly contracted specimens). Cerci, two, a little shorter than the body, with a short, unsegmented conical stump representing the third. Hairs on inner margin of cerci. Labrum wider than long.

Coloration (alcoholic). Distinct pattern on head and thorax, which seemingly differs from that of the other species, but it is doubtful if these patterns can be used as specific characters, because of change of intensity with phase of molt, which obscures and seemingly modifies the pattern. First femur with a J-shaped light mark (fig. 27) and second and third with a corresponding L-shaped mark (fig. 28). Abdominal terga with a color pattern hard to describe, but third, fourth and seventh are decidedly darker than the others.

Described from a nymph from Toland, Colorado, August, 1921.

Baetis intermedius new species (Figs. 29 to 33.)

Imago. Imagos of both sexes were reared from nymphs taken at 9,000 feet, and also were collected in South Boulder Valley from 8,800 to 11,000 feet.

♂. Length of body, 6 mm. Cerci, two, 10 mm., with a short rudiment of the third on a conical base. Fore-wing, 6.5 mm. Hind-wing, 1.1 mm., with two main longitudinal veins arising

from a short stalk, a third faint longitudinal vein extending from base to middle of hind margin, and one intercalary between this and the second longitudinal vein (fig. 29). Male forceps three-jointed: first short, stout, tapering; second long, about uniformly curved, basal fourth decidedly thicker than the remainder; third with its greatest thickness equal to about two-thirds its length and beyond the middle (fig. 30).

Coloration (alcoholic). Thorax, dark brown; abdomen, light brown.

Type.—♂; Tolland, Colorado, August, 1921.

Allotype.—♀, from same locality as type. Similar to male except for sex differences. Color, uniform light brown.

Nymph. Lives in swift water, but apparently not as swift as that frequented by *B. bicaudatus*. It clings to surface of rocks where water is swift, and lives in less rapid water among sedges, but not in sluggish parts of stream. Elevation of habitat, 8,500 to 11,000 feet.

Length, 6 mm. Cerci, three, the two lateral ones, 6 mm., with fringe of hairs on mesial side; the middle one is about one-sixth the length of the others, very slender and with very scant hairs. Gills on segments one to seven, each of a single lamella with tracheae showing only faintly, and each gill covering only the base of the next gill.

Coloration (alcoholic). A very definite color pattern, hard to describe, and varying somewhat with degree of pigmentation (fig. 33). First femur with light area like a letter J with the hook filled solid (fig. 31), the second with a corresponding L-shaped light area (fig. 32). Labrum about twice as wide as long. Abdominal terga nine and ten pale, the fifth somewhat less so.

Described from a nymph from Tolland, Colorado, August, 1921.

Baetis tricaudatus new species (Figs. 34 and 35.)

Imago. Imagos of both sexes were reared from nymphs taken at 10,500 feet. Collected generally in South Boulder Valley, 8,800 to 11,150 feet.

♂. Length of body, 7 mm. Cerci, two, 11 mm., at hird represented by a blunt stump with a minute rudiment of a cercus. Fore-wing, 7 mm. Hind-wing, 1.4 mm., with three longitudinal veins: first and second arise from a short stalk; third small and lying close to the basal half of the posterior margin; two intercalaries between second and third (fig. 35). Male forceps three-jointed: first short, stout, tapered; second long, uniformly curved on outer surface, inner surface with decided wrinkled thickening

on first fourth of length; third joint short, about as thick as second, elliptical, with greatest thickness about middle (fig. 34).

Type.—♂; Tolland, Colorado, August, 1921.

Allotype.—♀, from same locality as type. No special descriptions needed. Similar to male except for usual sex differences.

Nymph. Lives in moderately swift streams, but not in as swift parts as either of the preceding nymphs (*B. bicaudatus* and *intermedius*). In South Boulder Creek and is tributaries, 5,500 to 11,150 feet.

Length, 7 mm. Cerci, three, the two lateral ones about 7 mm., with hairs on inner margin, the third about one-half as long and somewhat more slender, with fairly long hairs on both sides. Labrum wider than long. Gills on segments one to seven all single and with distinct tracheae; the fourth is the largest, the seventh larger than the first, and each gill overlaps the base of the second gill caudad of it.

Described from a nymph from Toland, Colorado, August, 1921.

Baetis quilleri new species (Fig. 36.)

Imago. South Boulder Creek on the plains near the foothills (5,200 feet). Only females have been collected.

♀. Length of body, 4 mm. Cerci, two, about one and one-half times length of body. Fore-wing, 5 mm. Hind-wing, 0.8 mm., narrow, with prominent, curved humeral point, three longitudinal veins; first and second distinct and arising close together, but not from a common stalk; third faint and near hind margin, where it ends at about three-fourths length of wing. There are two faint cross-veins between second and third longitudinal veins (fig. 36).

Type.—♀; Boulder, Colorado, July, 1915.

Baetis moffatti new species (Figs. 37 and 38.)

Imago. Both sexes have been collected in South Boulder Valley, 5,900 to 11,000 feet.

♂. Length of body, 7 mm. Cerci, two, one and one-half times length of body. Fore-wing, 7.5 mm. Hind-wing, 1.4 mm., with three longitudinal veins: first and second strong and stalked; third faint and ending in hind margin at about middle (fig. 38). Male forceps (fig. 37) three-jointed: first stout, tapering; second long, about uniformly curved, first fourth thicker than the rest, the thickening being evident on both inner and outer margins; third

about as thick as second and nearly twice as long as its greatest thickness, which is beyond the middle of the joint.

Type.—♂; Tolland, Colorado, August, 1915.

Allotype.—♀, from same locality as type. Similar to male except for sex differences and greater size of female, its fore wing measuring 8.5 mm.

Baetis minimus new species (Fig. 39.)

Imago. Only the female is known. South Boulder Valley, 6,700 to 10,400 feet.

♀. Length, 5 mm. Fore-wing, 7.5 mm. (Note large wing for so small a body.) Hind wing, 0.8 mm., with three longitudinal veins: first and second strong and stalked; third faint and ending in hind margin at about middle (fig. 39). This species is much like *B. moffatti*, but differs in small size of body in relation to fore wing, and in small size of hind wing in relation to fore wing.

Type.—♀; Tolland, Colorado, August, 1915.

Baetis parvus new species (Figs. 40 and 41.)

Imago. Both males and females have been collected on South Boulder Valley, 9,000 to 10,500 feet.

♂. Length, 5.5 mm. Cerci, two, two and one-half times length of body. Fore-wing, 5.5 mm. Hind-wing, 0.95 mm., with three longitudinal veins: first and second are strong and stalked; second is forked at about one-third its length with one intercalary in fork; the third ends in the posterior margin a little beyond the middle (fig. 41). Male forceps three-jointed: first short and somewhat tapering; second long, its basal thickening extending to about half its length, tapering gradually to its end, where a slight, abrupt contraction takes place; third joint with greatest thickness equal to one-third its length, its proximal half being about uniform in thickness and a swelling is present on inner surface of distal half (fig. 40).

Type.—♂; Tolland, Colorado, July, 1915.

Allotype.—♀, from same locality as type. Similar to male except for usual sex differences.

Explanation of Figures

Fig. 1.—*Drunella grandis.* Fore wing.
Fig. 2.—*Drunella grandis.* Male genitals.
Fig. 3.—*Ephemerella coloradensis.* Fore wing.
Fig. 4.—*Ephemerella coloradensis.* Male genitals.
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Fig. 9.—*Ecdyurus ramalei.* Male genitals.
Fig. 10.—*Ecdyurus ramalei.* Femur of nymph, showing coloration.
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Fig. 17.—*Ameletus velox.* Male genitals.
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Fig. 19.—*Iron longimanus.* Ventral view of abdomen of nymph.
Fig. 20.—*Iron longimanus.* Head and thorax of nymph.
Fig. 21.—*Iron longimanus.* Immature male genitals.
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Fig. 23.—*Iron* nymph no. 1. Ventral view of abdomen of nymph.
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Fig. 26.—*Baetis bicaudatus.* Hind wings.
Fig. 27.—*Baetis bicaudatus.* First femur of nymph.
Fig. 28.—*Baetis bicaudatus.* Second and third femora of nymph.
Fig. 29.—*Baetis intermedius.* Hind wing of imago.
Fig. 30.—*Baetis intermedius.* Male forceps.
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Fig. 32.—*Baetis intermedius.* Second and third femora of nymph.
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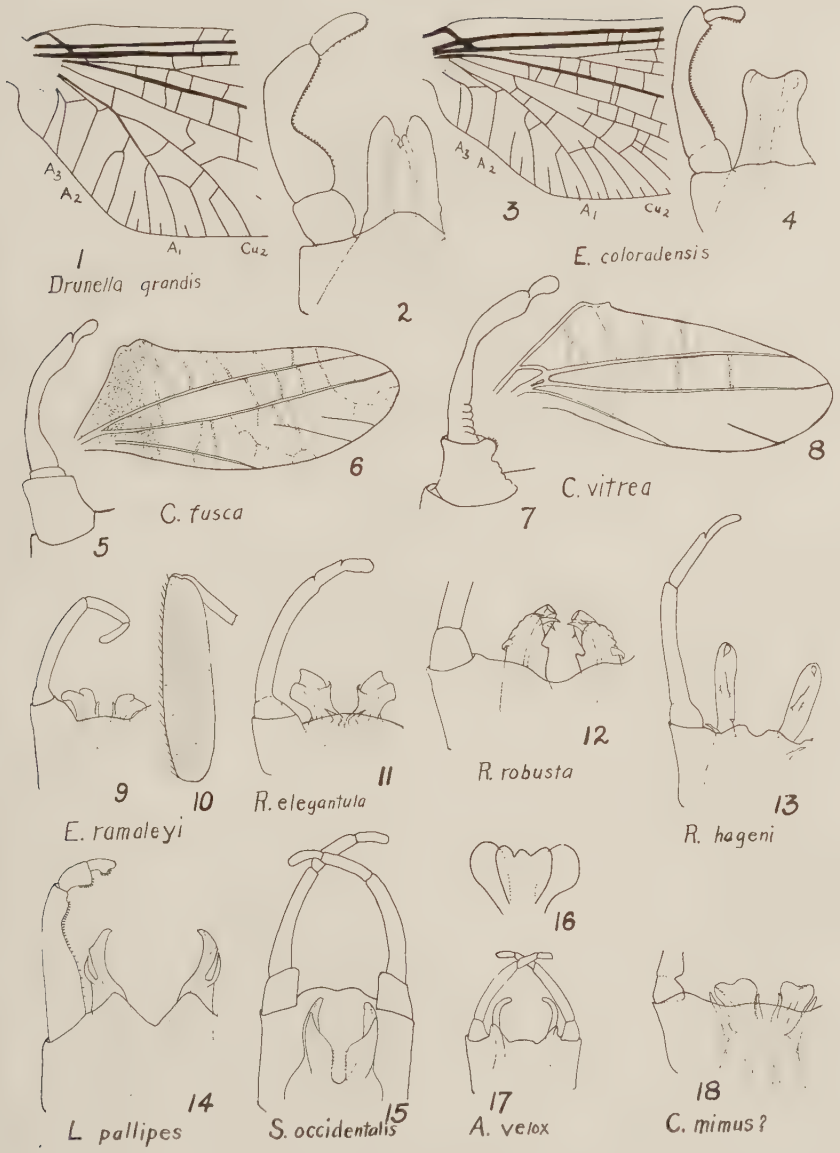
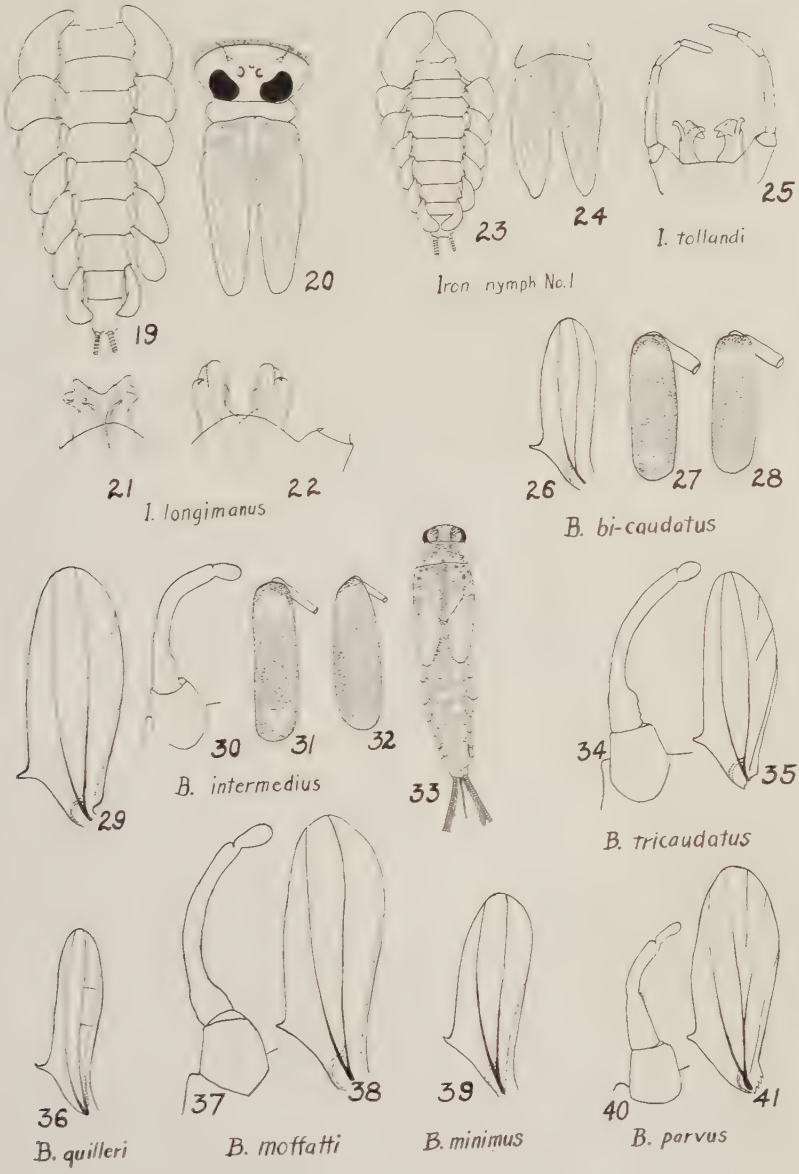
Fig. 34.—*Baetis tricaudatus.* Male forceps.
Fig. 35.—*Baetis tricaudatus.* Hind wing.
Fig. 36.—*Baetis quilleri.* Hind wing.
Fig. 37.—*Baetis moffati.* Male forceps.
Fig. 38.—*Baetis moffati.* Hind wing.
Fig. 39.—*Baetis minimus.* Hind wing.
Fig. 40.—*Baetis parvus.* Male forceps.
Fig. 41.—*Baetis parvus.* Hind wing.



DODDS—COLORADO MAYFLIES



DODDS—COLORADO MAYFLIES

MICROLEPIDOPTERA: NOTES AND NEW SPECIES

BY ANNETTE F. BRAUN

Cincinnati, Ohio

COSMOPTERYGIDAE

Cosmopteryx gemmiferella Clemens

The larva mines the small basal leaves of *Panicum dichotomum* Linnaeus, in the spring, eating out almost the entire substance of the leaf. Just before pupation, it enters one of the lower stem leaves, in which it makes a small inconspicuous mine, scarcely larger than the larva, but broadening at its anterior end toward the tip of the leaf, slightly inflated, and showing as a convexity on the upper surface of the leaf. Within this cavity, which is silk-lined, pupation takes place. Beyond the pupation chamber, the mine extends a short distance forwards, but is scarcely visible except at its end, where the epidermis is almost eaten through, permitting the emergence of the imago.

There is apparently but one generation a year; the moths appear from the latter part of May to July.

TANYGONA new genus

Labial palpi very long, recurved, smooth, third segment longer than the second. Antennae nearly as long as the fore wings, first segment long, swollen distally. Fore wings lanceolate acuminate; 1b furcate, 2 from end of cell beyond 10, 3 absent, 7 and 8 out of 6, 7 nearly from the tip of 6. Hind wings one-third the width of the fore wings, somewhat broader in the female than in the male; 3, 4 and 5 absent, 6 and 7 stalked. Posterior tibiae with long fine hairs above.

Genotype: *Tanygona lignicolorella* new species.

In structural characters, *Tanygona* agrees almost exactly with *Cosmopteryx*, except for the long hairs of the posterior tibiae, and a row of scales in the cilia around apex in the fore wing. This row of scales is not present in the species of *Cosmopteryx*.

Eriphia (?) *albalineella* Chambers is very similar in general appearance to the species described below, and agrees with it exactly in palpal and antennal characters and general type of

markings, and should probably be placed in this genus. The three species placed by Chambers in his genus *Eriphia* are not congeneric.

Tanygona lignicolorella new species

Palpi dark brown, a white line along the lower edge, and another along the upper edge to the tip; antennae dark brown, shading to brownish ocherous toward tip, longitudinal white lines along the upper and lower sides respectively, which toward the tip blend into the brownish color. Head brownish ocherous, with three longitudinal white lines which continue backwards along the thorax. Fore wings brownish ocherous; a short white basal line in the fold; a fine white line along dorsal edge to beyond middle; at basal fourth a very oblique white costal streak to fold, thence bending and running in the fold to the middle of the wing; from middle of costa a slightly less oblique white streak crosses to the cilia; at apical fourth a perpendicular streak broadest on costa; a few dark-tipped scales between this streak and a white spot on costa almost at apex; extreme apex of wing dark brown; a line of dark brown scales around apex. Hind wings and cilia pale grayish white, tinged with ocherous. Legs grayish white, hind tibiae and tarsi brownish ocherous, with white spots at bases of spurs and at apices of segments. Expanse: 9 to 10 mm.

Type (♂), Cincinnati, Ohio, July 14; three paratypes (♂ and ♀), July 5 to 27, all in the writer's collection.

Psacaphora annulata new species

Palpi silvery white inwardly, fuscous outwardly, with two black rings around the third segment. Antennae silvery beneath, fuscous above in the basal half, black in the outer half, with the tip white; before the tip, five white segments, separated each from the next by two black segments. Face silvery, shading darker on the head, which is gray metallic in the type, almost black in the paratype. Thorax and fore wings black; an oblique silvery bar at basal fourth reaching fold; just beyond and a little below fold a patch of black raised scales; at apical third a slightly inwardly oblique silvery fascia, the scales of which just within the dorsal margin form a raised patch; a line of silvery scales from just before tip of wing around apex to the tornus; two parallel rows of black-tipped scales in the cilia. Hind wings and cilia gray. Legs black, with tips of segments and a median band on the tibiae silvery. Abdomen silvery beneath, fuscous above, with posterior margins of segments silvery. Expanse: 7 mm.

Type (♂), Cincinnati, Ohio, July 20; paratype (♂), Sugar Grove, Ohio, May 31, both in the writer's collection.

Psacaphora difficilis new species

Palpi silvery within, dark fuscous outwardly; antennae fuscous, black towards apex, with four or five indistinct paler annulations in the outer half. Face silvery, head becoming dark metallic behind. Thorax and extreme base of fore wing dark metallic, rest of wing dark brown; a golden metallic band at basal third, broadening toward the base on the dorsum; behind it just within the dorsal margin, a patch of raised black scales; at apical third, a transverse golden fascia, with a patch of raised black scales behind it; around the tip of the wing, a row of metallic violet-tinged scales, angulated at the apex, followed by a row of black scales and beyond them, a row of fuscous scales reaching nearly to the tip of the silvery apical cilia. Hind wings and cilia dark gray, brownish tinged. Underside of body silvery. Tibiae and tarsi black, with tips of segments silvery and a silvery band around middle of hind tibiae. Expanse: 7 mm.

Type (♂), Cincinnati, Ohio, June 13, in the writer's collection.

Similar in general appearance to the preceding species, but distinct.

OECOPHORIDAE

Epicallima amplicincta new species

Palpi yellowish white, with tip of second segment and a few scales on the third segment fuscous. Antennae black, tips silvery. Head and thorax dark brown. Fore wings dark brown and orange, the orange occupying less than half the wing area, and nowhere touching the wing margins, and only extending into the dorsal half of the wing just beyond the fascia at the basal fourth; a lobe of orange extends into the apical third of the wing, everywhere separated from the wing margins by a band of brown ground color at least as broad as the orange lobe. At basal fourth, a curved metallic fascia, slightly blue-tinged, joins, below the fold, a pale golden quadrate spot, both margined with dark brown; on middle of costa a pale golden dash, and beneath and parallel to it a pair of longitudinal metallic streaks; at apical third below costa a metallic spot. Cilia brown, with slight bronzy reflections. Hind wings and cilia brown. Fore and middle legs yellowish, fore pair fuscous outwardly, middle tibiae fuscous at tips; hind legs grayish, with last two or three tarsal segments and the spurs silvery. Expanse: 9.5–11 mm.

Type (♂), Cincinnati, Ohio, June 5; three paratypes (♂), Cincinnati, June 13; one paratype (♀), Powell County, Kentucky, June 26; all in the writer's collection.

This species is very close to *E. lucidella* Busck, but differs from it by certain constant characters which are: the less extent of the orange color, which is not sharply limited as in *E. lucidella*; the different shape and color of the basal fascia and the larger dorsal spot.

Ethmiidae

PYRAMIDOBELA new genus

This generic name is proposed for the species described by me as *Enicostoma quinquecristata*.[1] The position of vein five of the hind wing (closer to six than to four) and a study of the male genitalia made by Mr. August Busck show that the genus is referable to the Ethmiidae and not to the Oecophoridae. Mr. Busck informs me that of the published figures of male genitalia, *quinquecristata* comes nearest to *Ethmia marmorea* Walsingham.[2] The genus *Enicostoma* is typically Oecophorid in its characters.

Glyphipterygidae

Hilarographa olympica new species

Palpi white, outer edge of second and lower side of third segment brown. Face shining gray, head and thorax dark brown. Fore wings golden brown, more or less overlaid with dark brown along the costa and in the dorsal half of the basal two-thirds of the wing. Five silvery white costal streaks, dark brown-margined, the silver of the third and fourth streaks shading to metallic blue in the middle of the wing, the first four oblique, the fifth just before apex nearly perpendicular. The first two meet the apices of two silvery dorsal streaks forming angulated fasciae, the first fascia acutely angled and its apex prolonged as a silvery streak along middle of wing nearly to the second fascia. Almost at tornus and widely distant from the second dorsal streak, is a larger silvery brown-margined dorsal streak, bent outward on fold and then nearly perpendicular to above middle of wing, thence bending outward to its apex which is metallic blue; at middle of termen, a triangular metallic blue spot, broadly margined with black on the termen; its apex meets the apex of the preceding dorsal streak. Cilia dark golden brown,

[1] Proc. Acad. Nat. Sci. Phila., p. 11, (1921).

[2] Barnes and Busck, Contrib. Nat. Hist. Lep. N. A., IV, no. 3, pl. 36, fig. 5, (1920).

silvery at apex and with a silvery white pencil just beneath apex. Hind wings and cilia dark brown. Legs gray, tips of tarsi silvery, last three tarsal segments of hind legs black. Abdomen dark brown, beneath banded with silver on each segment. Expanse: 13 mm.

Type (♀), Olympic Hot Springs trail, Clallam County, Washington, July 27, about 500 feet altitude (E. Lucy Braun, collector).

Similar to *H. youngiella* Busck in the markings of the costal half of the wing, but very different in dorsal markings from either of the other American species.

Coleophoridae

Coleophora prepostera new species

Palpi white, upper half and a minute projecting tuft on the second segment pale fuscous. Basal segment of antennae somewhat enlarged, scales projecting slightly in front; stalk grayish or whitish, with more or less distinct darker annulations. Wings pale grayish ocherous, more or less tinged with fuscous, the ground color deepest adjacent to the costa which is white from the base to the costal cilia; beyond the middle of the wing the white edge is not sharply separated from the ground color. The wing is usually marked with lines of scattered fuscous scales, which in most instances are scarcely darker than the ground color, and sometimes not discernible except here and there. Hind wings gray, darker than the fore wings. Legs whitish. Expanse: 15 to 18 mm.

Type (♂), July 14, Glacier Park Station, Montana, and twenty-four paratypes (♂ and ♀), July 14 and July 28, Glacier Park Station, Montana, in the writer's collection. Paratypes in the collection of the Academy of Natural Sciences of Philadelphia.

This is the species referred to as *C. albacostella* Chambers;[3] an examination of *albacostella* in the Museum of Comparative Zoology at Cambridge, Massachusetts, shows that it is a relatively broader-winged species, darker, and with white costal edge more distinctly limited.

Elachistidae

Elachista controversa new species

Palpi white, antennae white at the base, shading outwardly to gray; head, thorax and fore wings pure white; a few minute light brown specks (five or six) scattered irregularly in the outer half

[3] Braun, Proc. Acad. Nat. Sci., Phila., 1921, p. 14.

of the wing. Hind wings very pale gray, with white cilia which are yellowish at their bases. Underside of both pairs of wings gray, fore wings the darker. Legs white, tarsi pale grayish. Abdomen white. Expanse: 11 to 12.5 mm.

Type (♂) and three paratypes (♂), Monache Meadows, Tulare County, California, 8000 feet, July 10; all in the writer's collection.

Differing from its nearest ally, *E. aurocristata* Braun, by the purer white of the fore wings and the entirely white abdomen and anal tuft of the male. Venation as in *E. orestella* Busck.

Gracilariidae

Lithocolletis viburnella new species

Palpi white, face golden, tuft dark brown; antennae dark brown above, silvery gray beneath, last seven or eight segments before the tip silvery white, tip black. Thorax and fore wings brilliant golden, with silvery white markings, all internally margined with dark brown; a short median basal streak to one-fifth, margined above and around its apex with dark brown: at one-third, a slightly curved fascia, and beyond it, three costal and two dorsal streaks, the first dorsal reaching above the middle of the wing, its apex beyond that of the first costal; an elongate black apical spot; last row of scales around apex bluish metallic. Cilia pale golden. Hind wings and cilia brownish gray. Legs silvery gray. Abdomen silvery beneath, dark brown above. Expanse: 7 mm.

Type (♀), reared from a mine on *Viburnum dentatum* Linnaeus, Martinsville, Ohio.

The mine is elongate, occupying the space between two veins; the wrinkling of the lower epidermis almost brings the veins together. Near the midrib, a small circular patch on the upper side is left uneaten, beneath which pupation takes place. Mine found September 14; imago May 12.

Nearest to *L. martiella* Braun.

Apophthisis congregata new species

Labial palpi white, end of second and a band around third segment dark brown. Face and head white, with sparse dark brown dusting. Antennae fuscous, with paler annulations. Thorax white, dusted. Fore wings white, with dark brown dusting which is densest in the outer half of the wing and has a tendency to collect into patches. A line of dark brown scales

around apex of wing and a fainter straight line in the white apical cilia. Hind wings pale gray. Legs alternately brown and white banded. Abdomen whitish. Expanse: 6.5 to 7 mm.

Type (♂) and two paratypes (♂), Camp Baldy, San Bernardino Mountains, California, July 27.

The venation of the fore wing agrees in every respect with that of the type of the genus, except that the veins obsolescent in that species are even more indistinct here; the hind wing is narrower than that of the type species and correlated with the narrowing there is a reduction in venation; five and six are reduced to a single vein running through the cell to the base, and only a very faint indication of the outline of the cell is visible beyond vein two.

Gracilaria scutellariella new species

Labial palpi with the second segment yellowish, blackish externally on its outer half; third segment blackish, with base and tip yellowish; maxillary palpi similarly colored. Antennae dark brown; with faint paler annulations. Head dark brown; thorax and fore wings dark brown with pronounced purple luster. The wings are faintly mottled with a paler brownish color; this mottling is usually confined to the costal and dorsal margins, and on the costal margin it takes the form of faint spots and strigulae, mostly arranged in pairs. Cilia brown, with three deeper purplish brown lines. Hind wings and cilia dark grayish brown, purplish tinged. Fore and middle pair of legs deep purplish brown, tarsal segments yellowish with brown tips; hind legs brown, with bases of segments whitish. Abdomen yellowish beneath, purplish above. Expanse: 9 to 10 mm.

Type (♂) and nine paratypes (♂ and ♀), Cincinnati, Ohio, reared from larvae mining leaves of skullcap, *Scutellaria versicolor*.

The mine is large and inflated, with a much wrinkled lower epidermis; most of the parenchyma of the leaf is finally consumed. The larva spins the usual type of oval cocoon, immediately after leaving the mine. There are several generations a year, in fact mined leaves may be found at almost any time from June to October. The type specimen emerged September 9; paratypes, July 17 to 19 and September 12 to 13.

Type and eight paratypes in the writer's collection: one paratype in the collection of the Academy of Natural Sciences of Philadelphia.

Gracilaria porphyretica new species

Second segment of labial palpi yellow, third segment white with a dark brown tip; maxillary palpi yellow, dark brown in outer half of segments. Antennae brown, purplish toward base, with fainter annulations. Face yellow, head and thorax purple, middle of thorax posteriorly yellow. Fore wings brilliant purple, the deepest color in the costal part of the wing before the costal yellow area; an elongate yellow patch on the base of dorsum; a bright yellow costal area, beginning at basal fourth and reaching almost to the apex, extends downward to the fold, sometimes at one point a little below it, and along the fold almost to the middle of the wing, thence its outer margin curves upward to within one-third or one-fourth of costa; beyond this sending a short pointed projection toward the middle of the wing. The margin of the narrow portion of the costal yellow area is not usually clearly defined, the yellow passing gradually into the purple. Cilia brown with three darker brown lines. Hind wings gray, cilia brownish. Fore and middle legs dark brown with pure white tarsi, the tarsal segments sometimes minutely tipped with dark brown. Hind legs with basal segments bright yellow, posterior half of femora dark brown, tibiae and tarsi grayish straw-color, tibiae shading into dark brown toward apex, tarsal segments slightly darkened at their tips. Abdomen bright yellow beneath, brownish above. Expanse: 10 mm.

Type (♂) and three paratypes (2 ♂, 1 ♀), Balsam, North Carolina, from larvae on *Azalea*.

The mine is a tentiform underside mine, with wrinkled lower epidermis; later, the leaf is rolled from the tip downward onto the underside of the leaf; cocoon outside the roll, of the usual type. The moths were reared in 1911 and 1912. Larvae mining July 14, produced moths August 8 and 10; larvae collected in August produced moths August 20 and 23. Date of emergence of the type, August 8, 1911.

This species is nearest to *G. superbifrontella* Clemens, dark specimens of which approach it in color, but lack the deep brilliancy of the purple color of *porphyretica*.

Although allied to *G. azaleella* Brants, an imported species feeding on *Azalea*, it differs from that species in several important particulars.

Scythridae

Scythris reducta new species

Palpi dark gray, white scales on the outer and upper side of the third segment. Antennae dark gray. Head and thorax dark gray, streaked with white scales. Fore wings, vein three

indistinct, five absent; very dark slate gray almost black, with a faint purple luster; a broad white streak from base along middle of wing, forking beyond the middle, one branch following the fold to the margin, the other somewhat broken outwardly and reaching the margin below apex; a white streak from base within the costa to the costal margin before the middle; costal margin of wing beyond middle overlaid with white scales; white scales along the termen, and a few scattered white scales beneath the fold. Hind wings, veins four and five coincident, six and seven long stalked; brownish with scattered white scales in apical half, white beneath. Legs white, tibiae and tarsi of the first two pairs and tarsi of hind pair dark gray with white dusting. Abdomen white beneath and at sides of segments above; posterior segments white at base. Expanse: 9.5 to 11 mm.

Type (♀), Olancha, Inyo County, California, May 26; nine paratypes (3 ♂, 6 ♀) in the writer's collection; paratype (♀) in the collection of the Academy of Natural Sciences of Philadelphia.

A very distinct and strikingly marked species. The reduction in venation in the hind wings is unusual and the stalking of veins six and seven aberrant in the genus.

Scythris anthracina new species

Palpi gray, more or less overlaid with elongate white scales. Antennae gray, pecten white. Face and head gray with elongate white scales chiefly laterally and posteriorly. Thorax and fore wings with elongate gray and white scales about evenly intermingled; cilia pale gray; lower side in the female with two discal streaks of coal-black scales, and a short streak below fold. Hind wings, veins four and five separate, six and seven approximate for two-thirds their length; above grayish white at base shading into pale reddish ocherous outwardly; in the female an elongate black patch along basal half of dorsal margin; cilia pale reddish ocherous, gray around apex; beneath whitish. Legs with gray and white scales intermingled; femora and the hind tibiae almost white. Abdomen above in the male silvery at base shading to shining gray posteriorly, anal tuft tinged with red, whitish laterally; in the female with the base of the abdomen and the sides and median line above except the last few segments sprinkled with shining black scales similar to those on the wings; abdomen beneath in both sexes almost pure white. Expanse: 10 to 10.5 mm.

Type (♂), Palm Springs, Riverside County, California, March 25; *allotype* (♀), Palm Springs, March 26; four para-

types (♂), Palm Springs, March 25 and 26; all in the writer's collection, except one paratype (♂) in the collection of the Academy of Natural Science of Philadelphia.

The single female is associated with the males because of the structure of the scales on the underside of the abdomen, which in this species are comparatively short and broad. In a male of another species from the same locality, superficially very similar, these scales are extremely long and narrow.

Epermeniidae

Epermenia alameda new species

Palpi whitish inwardly, fuscous on the outside, the scales dark-tipped. Antennae fuscous. Head, thorax and fore wings grayish white, dusted with grayish brown, the scales shading outwardly to grayish brown and minutely whitish-tipped; some scales broadly black-tipped. The black-tipped scales form a series of minute costal strigulae, generally arranged in pairs, one or two small dots on costa before apex, and a rather conspicuous black patch at extreme apex of wing, a line of scales from this patch running a short distance along termen; a few inconspicuous dorsal strigulae; a minute black discal dot beyond middle, and a minute black streak at end of cell both encircled with whitish scales. The more uniformly brown scales form a definable oblique shade crossing from middle of costa to basal third on dorsum, broadest on costa; a roundish patch on middle of wing between the discal spots and a similar patch in apical third beyond. Four dorsal blackish scale teeth, the first large, at basal third, the second about half its size, the third and fourth minute. Cilia pale gray, a line of dark-tipped scales in cilia from costa around apex is deeply sinuate just below apex, thence running closer to and parallel to termen; starting below apex, and separated from the line of scales around apex by a pencil of whitish cilia is a second parallel line of dark-tipped scales. Hind wings and cilia pale gray. Legs whitish inwardly, densely dusted with blackish outwardly, spurs whitish. Expanse: 14.5 mm.

Type (♀) and one paratype (♀), Alameda County, California, June 15; in the writer's collection.

This species is closest to *Epermenia cicutaella* Kearfott.

Lyonetiidae

Bucculatrix floccosa new species

Face white, tuft white, with brownish ocherous hairs in the middle. Antennal eye-caps and the first few segments following white, remaining segments white at base shading through ocher-

ous to dark brown, darkest toward the tip of the antennae. Fore wings white, with patches of very pale yellow minutely dark brown-tipped scales; a few of these scales within the costa near base; a rather large patch on the middle of the wing at about the basal fourth; a smaller patch on costa before middle extending about one-third across the wing; a large patch beginning about middle of dorsum, extending half way across the wing, a few of the scales on its inner edge more deeply black-tipped and raised; a large patch beyond middle of costa, its outer edge concave, ending in a small patch of more deeply black-tipped scales on the middle of the wing; these last three patches sometimes more or less confluent; a patch before apex on costa; similar scales at apex and along termen to tornus, forming a considerable patch at tornus and at apex more deeply black-tipped. Black-tipped scales in the white cilia at apex. Hind wings yellowish white. Legs white, tarsal segments black-tipped. Abdomen white. Expanse: 9 mm.

Type (♀) and four paratypes (1 ♂, 3 ♀), Olancha, Inyo County, California, May 10 to June 16; in the writer's collection.

In some of the specimens, the patches of yellowish black-tipped scales are much reduced, consisting of merely a scattered few of the more deeply black-tipped scales.

Bucculatrix nigripunctella new species

Face, head and antennae white, the antennal stalk with dark fuscous annulations. Fore wings white, with a very faint, scarcely distinguishable, pale grayish straw-colored suffusion along the middle of the wing nearly to apex, connecting with patches of blackish brown scales placed as follows: a few (two to six) separate blackish scales in the basal half of the wing, two or three just above the fold, two or three below it; three small patches on costa about equally spaced, the first before the middle, the third and largest lies before the apex and includes some narrowly brown-tipped scales; a line of three black scales in the disk at three-fourths; a patch beyond middle of dorsum and another at tornus; a number of black scales in apex, some of them forming a broken line at base of cilia. Hind wings white with a faint yellow tinge. Legs white with a faint yellowish tinge. Abdomen dull straw-colored. Expanse: 7.5 to 8 mm.

Type (♂) and one paratype (♂), Palm Springs, Riverside County, California, March 26; in the writer's collection.

This species is characterized by the conspicuously contrasting black atoms; the paratype shows fewer of these black scales in the basal and apical parts of the wing.

Tischeria explosa new species

Palpi, face and head grayish white, antennae gray, with short ciliations in the female, long in the male. Thorax and fore wings dull sordid white with rather sparse fuscous dusting. Hind wings grayish, cilia faintly ocherous. Legs whitish except the fore pair, which are gray. Abdomen grayish white. Expanse: 6 to 7 mm.

Type (♂) and four paratypes (♂ and ♀), Palm Springs, Riverside County, California, March 26 to 28; in the writer's collection; one paratype (♂) in the collection of the Academy of Natural Sciences of Philadelphia.

Somewhat resembling *T. pulvella* Chambers, which is also a whitish dusted species but broader winged.

Tineidae

Xylesthia albicans new species

Labial palpi white, outer half of second segment densely dusted with fuscous, and scales of the brush here reddish ocherous; third segment dusted beneath. Head white, some of the hairs ocherous tinged. Thorax white with fine dusting mostly anteriorly. Fore wings white; groups of black-tipped scales on the costa indicate the position of transverse fasciae, situated as in *pruniramiella;* these fasciae are usually not traceable across the wing except as very faintly ocherous shades, in which a few of the scales are minutely black-tipped; sometimes the dusting, though very minute, is so general and irregularly placed that the costal patches give the only indication of transverse markings; a patch of somewhat darker dusting in the cell beyond the middle and at the end of the cell. A large black scale tuft below fold before the middle of the wing and other scattered minute scale tufts. Cilia white, a group of dark-tipped scales before apex and two near tornus; scales around apex pale ocherous shading brownish outwardly. Hind wings shining pearly gray, with whitish cilia. Legs white, fore and middle tibiae and tarsi densely dusted with dark fuscous, with tips of tibiae and tarsi and a median band on tibiae white; hind legs dusted with light brown. Abdomen white, dusted with brown. Expanse: 13.5 to 14.5 mm.

Type (♂) and two paratypes (♂), Olancha, Inyo County, California, June 16, 19, and 25; all in the writer's collection.

Identical in structure with *pruniramiella,* but at once distinguished by the almost white wings.

Incurvariidae

Lampronia fuscoleuca new species

Labial and maxillary palpi clothed with gray and white scales intermingled; face and head gray, with a sprinkling of whitish hairs; antennae gray with white pubescence. Fore wings lustrous, clothed with whitish and fuscous scales, about evenly intermingled in most specimens; across the end of the cell a patch of darker scales; a few of these darker scales in the fold near base. In some specimens, in the middle of the wing before the dark patch across the discal vein, below the apex beyond it, and in a patch on dorsum before tornus, the whitish scales predominate. Cilia white and gray, all gray-tipped. Hind wings with a faint purplish bronzy luster; basal half of costal area with hair scales and lacking the bronzy luster. Fore and middle legs dark fuscous, with some white scales; hind tibiae pale gray, tarsi pale fuscous and white. Abdomen gray. Expanse: 18 to 22 mm.

Type (♂) and four paratypes (♂), Dutch Flat, Placer County, California, March 16 to 27; in the writer's collection.

ON THE MALE GENITALIA OF THE HESPERIIDAE OF NORTH AMERICA.

PAPER III

BY HENRY SKINNER AND R. C. WILLIAMS, JR.

This paper will treat of the first section of the Pamphilinae, Lindsey's Groups A, B and C to *Pamphila*, from whence we pass to *Amblyscirtes*, *Lerodea* and Group D.

The genus *Amblyscirtes*, seems to us to be related to the first section of the Pamphilinae, and even to the Hesperiinae. The slender antennae, the feebly developed stigma —sometimes almost absent—and the genitalic characters, indicate such relationship. We include in the genus the species previously assigned to *Mastor* Godman, *oslari* forming a connecting link, and we include *carolina*, sinking the genus *Epiphyes* Dyar erected for it, all of these species having genitalia very close to *vialis*, the type of *Amblyscirtes*. The genitalia are remarkable for the great length of the aedoeagus and the corresponding length of the saccus, drawn out into a slender tube ending in a bulb, which may be more or less prominent in the same species. The aedoeagus is split at its apex and the two lobes provided with more or less developed fine teeth. The shape of the uncus and of the valve is practically the same in all of the species.

For purposes of identification we offer the following key, and under the species give the salient points for separating those of each group.

A. Fringes checkered.
  a. Wings black or blackish.....Nos. 17 to 24
  b. Wings more or less brown or tawny.....Nos. 25 to 27
B. Fringes not checkered.....Nos. 28 to 31

The records given are of insects which we have observed and in the collections of the Academy of Natural Sciences of Philadelphia, the American Entomological Society, and of R. C. Williams, Jr.

The references under the species are to previous figures of the male genitalia, and our own remarks refer to the genitalia of the male insect only.[1]

1. **Carterocephalus palaemon** Pallas (Fig. 1.)

Scudder, Butterflies East. U. S. and Canada, III, pl. 37, fig. 2, (1889) (as *Pamphila mandan*).

The genitalia seem to be the same in American and European specimens.

Records: NEW HAMPSHIRE, Franconia, White Mountains, (Slosson); OREGON, Fort Klamath; ONTARIO, Nepigon (Skinner); ALBERTA, Laggan; ALASKA, Seward.

2. **Butleria pirus** Edwards (Fig. 2.)

Mabille and Boullet have described a variety of *pirus* under the name *semicaeca*,[2] from a single male from Utah, based on "only three apical points on the apex of the superiors below." In our series from Utah, New Mexico and southwest Colorado, the spots vary considerably, from two apical spots to a total of seven spots, and the variation occurs in each locality, so we believe *semicaeca* should fall as a synonym of *pirus*.

The elongate aedoeagus and saccus, as well as the shape of the valve, indicate a relationship between the genera *Butleria* and *Carterocephalus*. The membranous tube feeding the aedoeagus is, however, attached to the extreme internal end, instead of entering the aedoeagus just beyond the internal end on the dorsal side, as is much more usual in the Hesperiidae we have thus far examined.

[1] *Hesperia omaha* Edwards. Holland (Journ. N. Y. Ent. Soc., VI, p. 57, (1898)) has placed this as a synonym of *Padraona dara* Kollar, or one of its varietal forms. The type and a paratype are in the collection of the Academy of Natural Sciences in Philadelphia. While they are rather smaller than typical *dara* they are undoubtedly but a variety at best, and we believe with Dr. Holland that Mr. Newman's specimens were received from a dealer in exotics, who was careless as to his labels, or else Newman himself mixed these specimens with material received from Pike's Peak. A similar error will account for *Pamphila mingo* Edwards, recorded from Kanawha County, West Virginia, which Edwards himself placed as a synonym of *omaha* as recorded by Holland.

The type of *Potanthus californica* Scudder, which has also been placed as a synonym of *dara*, we could not find in the Scudder collection at Cambridge, Massachusetts.

[2] Bull. Soc. Ent. France, p. 100, (1917).

Records: UTAH, Provo, July, (Spalding), City Creek Canyon, July (Skinner), Park City, July; NEW MEXICO, Beulah, July, August (Skinner), Jemez Springs, June, (Woodgate); ARIZONA Mount Graham (Morrison).

3. **Butleria microsticta** Godman (Fig. 3.)

Biol. Cent.-Amer., Rhop., pl. 92, fig. 3, (1900).

This is a Mexican species reported as crossing the Border. We have a single male labeled "Mexico" and Mr. Frank E. Watson kindly sent us another for examination, from the collection of the American Museum of Natural History, New York, which agrees with our specimen and the description and figures of the species. This is from La Joya, Mexico, 4800 feet elevation, August 13, 1903, (M. E. Hoag), and it is from the genitalia of this insect that our drawing is made.

It differs from *pirus* and *polingi* principally in that the ventral lobe of the valve is provided with a comb of sharp teeth, in our specimens from four to six in number. Godman in the figure and description indicates *two* sharp teeth, and in this respect our insects do not agree with his type, but we are inclined to believe that the number of these teeth is variable, or that the insect from which Godman's figure was made had some of the teeth broken off or they were not all developed, and that our insects are conspecific with Godman's.

Our figure, in this case, also shows the well developed juxta around the aedoeagus.

4. **Butleria polingi** Barnes (Fig. 4.)

The genitalia are very similar to those of *pirus*.

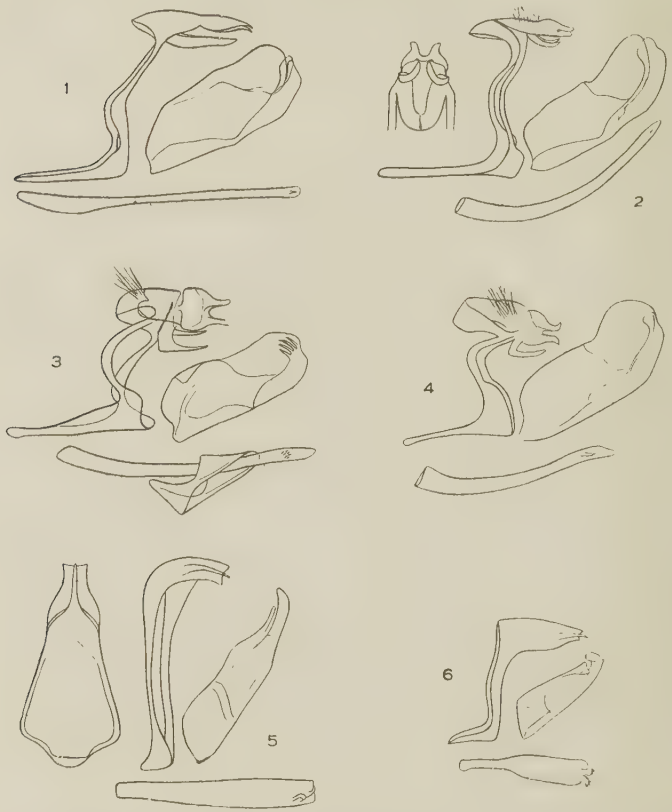
Records: ARIZONA, Huachuca Mountains, July (Poling); NEW MEXICO, Rio Ruidoso, White Mountains (Townsend).

5. **Ancyloxypha numitor** Fabricius (Fig. 5.)

Scudder, Butterflies East. U. S. and Canada, III, pl. 37, fig. 1, (1889).

The tegumen is very simple and unusual in shape. Near the end of the aedoeagus there are two small external lobes, somewhat shagreened.

Records: SOUTH DAKOTA, Volga (Truman); TEXAS, Round Mountains (Schaupp), April.



1. *Carterocephalus palaemon*, Europe. 2. *Butleria pirus*, Beulah, New Mexico. 3. *Butleria microsticta*, La Joya, Mexico. 4. *Butleria polingi*, South Arizona. 5. *Ancyloxypha numitor*, Chester, Pennsylvania. 6. *Ancyloxypha arene*, Uruapan, Mexico. (All × 15.)

6. **Ancyloxypha arene** Edwards (Fig. 6.)

Biol. Cent.-Amer., Rhop., pl. 92, fig. 38, (1900).

The uncus is similar to that of *numitor*, with a single spine beneath, and the two lobes near the extremity of the aedoeagus in *numitor* are represented by serrate processes in *arene*.

Records: Arizona, Mount Graham (Morrison); Mexico, Sonora, Colima, Uruapan, April, Mexico City (Williams), Vera Cruz (Williams).

7. **Oarisma edwardsi** Barnes (Fig. 7.)

Biol. Cent.-Amer., Rhop., pl. 92, fig. 25, (1900) (as *Paradopaea garita*).

Figures 23 and 24 of plate 92 in the Biologia are *garita*, not *edwardsi*.

The genitalia of *edwardsi*, *garita* and *powesheik* are very close, but this species may be distinguished from the two following by the bifurcate terminus of the valve.

Records: New Mexico, Fort Wingate, July (Woodgate), Jemez Springs (Woodgate); Arizona, Mount Graham (Morrison), Carr Canyon, Huachuca Mountains, Cochise County, July (Skinner).

8. **Oarisma garita** Reakirt (Fig. 8.)

Biol. Cent.-Amer., Rhop., pl. 92, fig. 29, (1900) (as *Paradopaea calega* on plate).

Figures 26 and 27 of Plate 92 in the Biologia (as *calega*) represent a rather dark *garita*, and such darker specimens seem to prevail in New Mexico, but we do not, however, consider that this is of sufficient importance to warrant the retention of the name *calega* as a racial or varietal form.

The end of the valve is not split, as is the case in *edwardsi*.

Records: Manitoba, Miniota, June (Gibson), Aweme, July (Skinner); Saskatchewan, Regina, July (Skinner) South Dakota, Williston; Utah, Park City, July (Snyder); Colorado, Hall Valley, August (Oslar), Fairview, June (Oslar), Idaho Springs, July, Fort Collins, July; New Mexico, Jemez Springs, June (Woodgate).

9. **Oarisma powesheik** Parker (Fig. 9.)

This species is readily distinguished from *garita* by its larger size, and the conspicuous white venation on the under side of the secondaries, against a brown ground color. In *garita* the venation of the secondaries below is present but not conspicuously white, and the ground color is olive on two-thirds of the wing, and orange with some brown shading on the inner section. We have not seen any individuals that might be considered intermediate forms between *powesheik* and *garita*, so we consider them to be two distinct species.

Powesheik, however, seems to be identical genitalically, with *garita* except for its larger size, as might be expected from the larger size of the insect.

Records: NEBRASKA, Lake Okoboti, June (Leussler); IOWA, Grinnell (Willard); ILLINOIS, Chicago (Worthington); SOUTH DAKOTA, Volga, July (Truman).

10. **Adopaea lineola** Ochsenheim (Fig. 10.)

Presumably imported from Europe and apparently established in London, Ontario, Canada.

The shape of the tegumen, the valve and the elongate aedoeagus indicate a relationship of the genus *Adopaea* to *Carterocephalus*, *Oarisma* and *Copaeodes*.

11. **Copaeodes aurantiaca** Hewitson (Fig. 11.)

The name *aurantiaca* has date priority over *waco* Edwards, both described in 1868, and the male of *procris* Edwards described in 1870, these names being synonymous.

Records: ARIZONA, Mount Graham (Morrison), Gila County (Poling), Carr Canyon, Huachuca Mountains, Cochise County, August (Skinner); TEXAS, Round Mountain, May, San Antonio; NEW MEXICO, Alamogordo, April (Viereck and Rehn); CALIFORNIA, Riverside, March, April, Palm Springs, April (Fox).

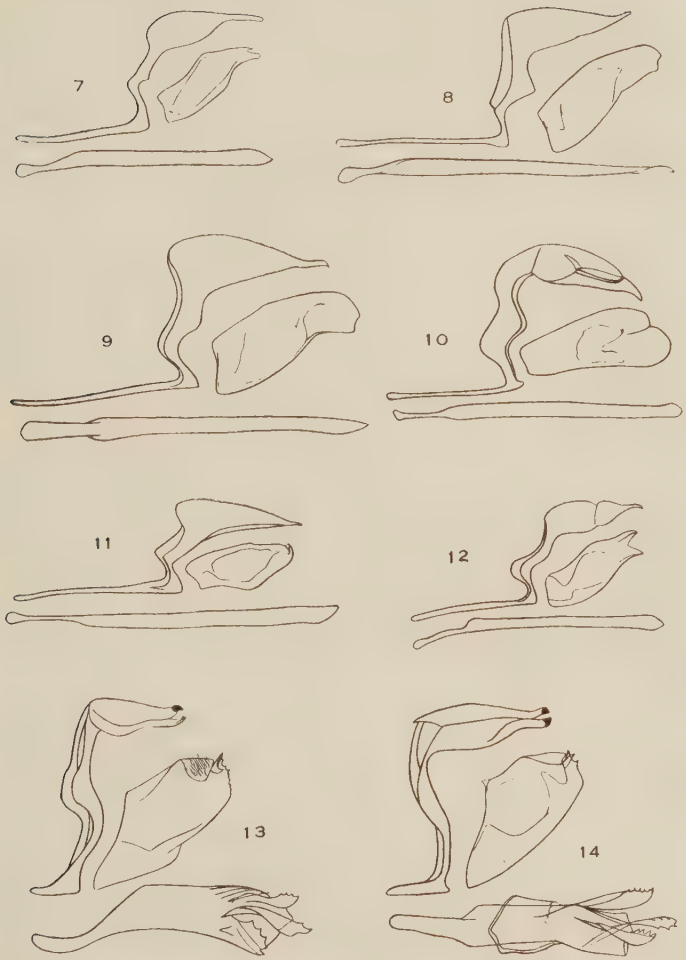
12. **Copaeodes minima** Edwards (Fig. 12.)

Biol. Cent.-Amer., Rhop., pl. 92, fig. 42 (as *aurantiaca*).

This species may be distinguished from *aurantiaca* by its smaller size, and the secondaries below are darker and carry a white ray across the disc. It is *rayata* of Barnes.

As Edwards had described three insects from the same locality, Waco, Texas, we asked Dr. Holland to examine the types of the three, which are in his Edwards Collection in the Carnegie Museum at Pittsburg, Pennsylvania. He very kindly did this for us and we quote the following from his letter of December 16, 1922.

"There are in the collection bearing the autograph labels of William H. Edwards of *Copæodes procris* six male specimens and two female specimens; two males from Texas; three males from Arizona; one male from Southern California; one female from Texas; and one female from Arizona. Besides these specimens, which bear the labels of W. H. Edwards, there are numerous other specimens acquired by me from Morrison and other older collectors.



7. *Oarisma edwardsi*, New Mexico. 8. *Oarisma garita*, Manitoba. 9. *Oarisma powesheik*, Grinnell, Iowa. 10. *Adopaea lineola*, Bournemouth, England. 11. *Copaeodes aurantiaca*, San Antonio, Texas. 12. *Copaeodes minima*, Mexico City, Mexico. 13. *Chaerephon rhesus*, Denver, Colorado. 14. *Chaerephon carus*, Silver City, New Mexico. (All × 15.)

"Of *C. minima* there is but one specimen bearing the label of W. H. Edwards. The label reads as follows: '*C. minima*, type, ♂, = *procris*.' On examination I find that the specimen is much smaller than any of the specimens of *C. procris* in the collection. I further find that the secondaries on the under side have a distinct longitudinal silvery white streak, which is not found in the case of any of the males of *C. procris*, so labelled by Edwards.

"Of *C. waco* there is but one specimen bearing this name in the handwriting of W. H. Edwards. It is evidently a male, though the label does not indicate the sex of the specimen. It is larger than *minima*, but superficially does not appear to be very different from *C. procris*, except that as I recall (I am writing in my office) it lacks the dark markings on the under side of the fore wing, which are conspicuous in *C. procris*."

The genitalia of *minima* differ from those of *aurantiaca* in the tegumen, and more conspicuously in the valve, which in *minima* is split at its terminus, ending in two points. This decided difference holds in a long series of mounts we have made from both species.

Records: TEXAS, San Antonio, Corpus Christi (Aaron); ARKANSAS, Hope, August, September, October (Knobel); MEXICO, Mexico City, November (Williams), Vera Cruz, December (Williams).

13. **Pseudocopaeodes eunus** Edwards (Fig. 15.)

This species was described from "Mt. Hood," but later this was corrected to "Bottoms of Kern River, near Bakersville, California." *Wrighti* Edwards was described a year later from "4 ♂, 2 ♀, part of 18 taken July, 1882 by W. S. Wright, Mojave Desert, Southern California." We have six of the original eighteen in the collections of the Academy in Philadelphia, from one of which was taken the male genitalia figured herewith. We are convinced that *eunus* and *wrighti* are synonymous, and the former having priority we sink the latter name.

The species is well figured by Wright in his Butterflies of the West Coast,[3] as *wrighti*, and the figures following, namely 413, b and c, we believe to be additional figures of the female of the species, 413 designated by Wright as a male having a stout abdomen indicating it is really of the opposite sex.

[3] Plate xxx, figs. 412 (♂) b (♀) and c (underside).

The male sex mark or stigma is peculiar and separates it from *Copaeodes*, in which genus it has until recently been placed, nor should it be placed in *Chaerephon*, from which it differs in color, shape and pattern of its male genitalia, and as we cannot find a genus in the Hesperiidae to which it can be properly assigned, we propose the name **Pseudocopaeodes,** with *eunus* as the type.

The male genitalia of *eunus* in the characters of the tegumen somewhat resemble those of the species of the preceding genera, but the shape of the valve, and the short stout aedoeagus, carrying external teeth, connect it with a group of Pamphilinae which, including *Chaerephon*, have the aedoeagi provided with complicated toothed processes at their extremities.

14. **Chaerephon rhesus** Edwards (Fig. 13.)

This species is figured by Godman and Salvin[4] and also by Skinner.[5] The male lacks the stigma and the color is black.

The type locality is Southern Colorado.

The genitalia are remarkable for the strong beaked terminus to the uncus, and the peculiar toothed lobes with which the aedoeagus is armed.

Records: Colorado, Denver, May (Oslar); New Mexico, Jemez Springs, May (Woodgate).

15. **Chaerephon carus** Edwards (Fig. 14.)

This species has not been figured. The male has a stigma and the color is brownish.

The type locality is West Texas.

The genitalia are quite similar to those of *rhesus*.

Records: Texas, Round Mountain, August (Schaupp); Arizona, Mount Graham (Morrison), Pinery Canyon, Chiricahua Mountains, June (Stone), Paradise (Duffner); New Mexico, Silver City, August (Wallis).

16. **Chaerephon simius** Edwards (Fig. 16.)

This species is figured by Holland.[6] Wright's figure is not *simius*, but *Amblyscirtes cassus*.[7]

[4] Biol. Cent.-Amer., Rhop., pl. 93, figs. 5, 6, ♀, 7, ♂, (1900).
[5] Ent. News. xi, pl. 12, figs. 19, 20, (1900).
[6] Butterfly Book, pl. 47, fig. 8, ♀, (1889).
[7] Butterflies of the West Coast, pl. xxxi, figs. 454, 454b, (1905).

There is no stigma. The color is generally brown with a yellow spot at end of cell, three subapical spots and a mesial band of about six spots of the same color not parallel to the margin. The underside of secondaries is gray with a whiter spot at base and a mesial band of the same color.

The type locality is Oak Creek Canyon, Colorado.

The genitalia differ considerably from those of *rhesus* and *carus*, but just as much from those of the species of *Amblyscirtes* with which it has previously been associated. On account of its superficial resemblance to *carus* we are retaining it in the genus *Chaerephon* where placed by Lindsey.

Records: COLORADO, Oak Creek Canyon, April (Neumoegen); NEW MEXICO, Silver City, August (Wallis); NEBRASKA, Harrison, July (Leussler).

17. **Amblyscirtes vialis** Edwards (Fig. 17.)

Scudder, Butterflies East. U. S. and Can., pl. 37, figs. 3, (1889).

Upperside. Primaries with three small subapical spots; otherwise immaculate.

Underside. Secondaries pruinose and immaculate.

Type information; Rock Island Illinois; Lake Winnipeg.

Records: MANITOBA, Miniota, June (Gibbon); BRITISH COLUMBIA, Corfield, Vancouver, June; CALIFORNIA, Trinity County, June (Fox), Yosemite; IDAHO, Priest Lake; COLORADO, Clear Creek Canyon, June (Oslar); NEW MEXICO, Jemez Springs, May, June (Woodgate); TEXAS, Round Mountain, April (Schaupp); NORTH CAROLINA, Cranberry, July (Thomas); Wilmington, April; NEW JERSEY, Woodbury (Skinner), Elizabeth; CONNECTICUT, Avon, June (Williams); NEW HAMPSHIRE, Franconia, White Mountains (Slosson).

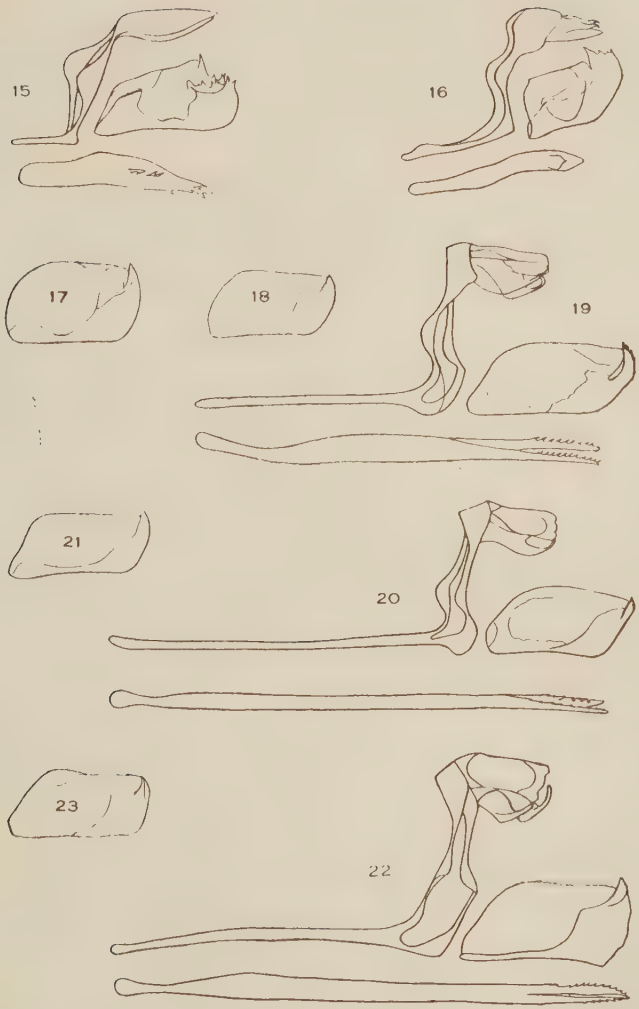
18. **Amblyscirtes alternata** Grote and Robinson (Fig. 18.)

Upperside. Primaries. Three subapical spots, very small (needle-like points). Three other small spots between the veins. Secondaries immaculate.

Underside. Primaries as above. Secondaries powdered with very small gray scales (irrorate).

Type information; Atlantic District, Georgia; Florida.

We have examined Edwards' type of *eos*, a male from Dallas, Texas, (Boll), and the irrorate underside of the secondaries is



15. *Pseudocopaeodes eunus*, Kern River, California. 16. *Chaerephon simius*, Silver City, New Mexico. 17. *Amblyscirtes vialis*, Cranberry, North Carolina. 18. *Amblyscirtes alternata*, Central Florida. 19. *Amblyscirtes hegon*, New Hampshire. 20. *Amblyscirtes nereus*, Mount Graham, Arizona. 21. *Amblyscirtes nysa*, Corpus Christi, Texas. 22. *Amblyscirtes textor*, Nashville, Tennessee. 23. *Amblyscirtes comus*, Corpus Christi, Texas. (All × 15.)

characteristic. We believe *eos* falls to *alternata*. There is another male in the Scudder Collection at Cambridge, Massachusetts, marked "*eos* type" which is *comus*.

Records: GEORGIA, Tifton, April (Pilate); ALABAMA, Whistler, September (Dukes).

19. **Amblyscirtes hegon** Scudder (Fig. 19.)

Scudder, Butterflies of East. U. S. and Can., pl. 37, fig. 4, (1889) (as *samoset*).

Upperside. Primaries with three very faint subapical spots and two others below them medially.

Underside. Primaries as above. Secondaries grayish green with a faint medial band parallel with the border.

Type locality; White Mountains, New Hampshire.

Records: MANITOBA, Stony Mountain, June (Wallis), Winnipeg, June (Wallis); NEW HAMPSHIRE, Franconia, White Mountains (Slosson); CONNECTICUT, Avon, June (Williams); IOWA, Grinnell (Willard); NORTH CAROLINA, Raleigh.

20. **Amblyscirtes nereus** Edwards (Fig. 20.)

Biol. Cent.-Amer., Rhop., pl. 95, fig. 30, (1900).

Upperside. Primaries with three subapical spots and four others in a line ending at the inner margin. Secondaries with a mesial band of five or six spots. Underside as in *hegon*. This species is close to *hegon* and is differentiated by the greater number and distinctness of the spots on the wings above.

Type locality, South Apache, Arizona.

Records: ARIZONA, Mount Graham (Morrison), South Arizona, July (Poling).

21. **Amblyscirtes nysa** Edwards (Fig. 21.)

Upperside. Three subapical white dots; otherwise immaculate. Secondaries with patches of brown and ashen spots.

Type information, Texas.

Records: TEXAS, Corpus Christi (Aaron), Round Mountain (Schaupp), San Antonio; ARIZONA, Baboquivari Mountains, July (Poling).

22. **Amblyscirtes textor** Hübner (Fig. 22.)

Upperside. This species varies on the upperside from immaculate to specimens with a band of six spots exclusive of the three apical ones.

Underside. Secondaries with a net work of white lines connecting two parallel bands across the wings.

Type information, America.

Records: TENNESSEE, Nashville, August; ALABAMA, Mobile (Dukes); GEORGIA, Augusta, May; FLORIDA, Central Florida (Morrison).

23. **Amblyscirtes comus** Edwards (Fig. 23.)

Fringes distinctly checkered black and white. Underside. Primaries with three white subapical spots and three other white dots at right angles to them. Secondaries with nine very distinct white dots on a gray background.

Type information, Texas (Belfrage).

Records: TEXAS, Corpus Christi (Aaron), Round Mountain, May, June (Schaupp), San Antonio; ARIZONA, Mount Graham (Morrison); NEW MEXICO, Highrolls, June (Viereck), Las Cruces (type of *quinquemaculata* Skinner).

24. **Amblyscirtes celia** Skinner (Fig. 24.)

Upperside. Primaries. Three small subapical dots and two medially below them (sometimes wanting in the female).

Underside. Primaries as above with two very faint spots between the apical ones and the other two. Secondaries. A band of six small mesial spots parallel to the outer border and two basally.

Type locality; New Braunfels, Texas (Schaupp). One ♂ type, one ♂ and one ♀ paratypes.

Records: TEXAS, Corpus Christi (Aaron) (two ♂ paratypes), Tiger Mill, April (one ♀ paratype), San Antonio.

25. **Amblyscirtes aenus** Edwards (Fig. 25.)

Upperside. Primaries. Subapical spots sometimes absent. A faint stigma in the male. Sometimes with a few yellow spots.

Underside. Secondaries with a faint mesial band of spots and one in cell and several on coast.

Type information, Southern Colorado.

Records: COLORADO, Chimney Gulch, Golden, June (Oslar), Coal Creek Canyon, July (Oslar), Clear Creek, June (Oslar), Manitou; ARIZONA, Carr Canyon, Huachuca Mountains, August (Skinner), Mount Graham (Morrison), Tucson; NEW MEXICO, Jemez Springs, June (Woodgate), Alamogordo, May (Viereck and Rehn); TEXAS, Tiger Mill, April, July (Schaupp), Round Mountain, September, Ingram, May (Dodge), San Antonio.

26. **Amblyscirtes cassus** Edwards (Fig. 26.)

Upperside. Primaries. Subapical and other spots fulvous or orange and one of same color at end of cell. Secondaries fulvous and more or less spotted.

Underside. Primaries as above with a fuscous basal patch. Secondaries gray-brown with two bands of gray-white spots. Interior margin of secondaries fulvous.

Type locality: Mount Graham, Arizona.

The genitalia of this species differ from those of all of the other species of *Amblyscirtes* with which we are dealing in that the aedoeagus is comparatively shorter and somewhat stouter, and the saccus is correspondingly shortened. This and *nanno* are the only two species of this genus that can be positively identified by the male genitalia alone.

Records: ARIZONA, Mount Graham (Morrison), Carr Canyon, Huachuca Mountains, July, August (Skinner), Baboquivari Mountains, July (Poling); NEW MEXICO, Jemez Springs, May (Woodgate).

27. **Amblyscirtes nanno** Edwards (Fig. 27.)

Biol. Cent.-Amer., Rhop., pl. 95, fig. 34, (1900).

Upperside. Primaries. A faint black stigma in the male. Three subapical spots and one or two below them and one at end of the discal cell.

Underside. Secondaries gray with five discrete white spots parallel to margin, two near costa and one larger one in the cell. This is the largest of our species.

Type locality; Fort Grant, Arizona.

This species can be distinguished genitalically by the two stout teeth just before the serrated terminal lobes of the extremity of the aedoeagus.

Records: ARIZONA, Mount Graham (Morrison), Carr Canyon, Huachuca Mountains, Cochise County, August (Skinner), Reef, Cochise County (Biederman),[8] Paradise, July (Duffner).

[8] **Amblyscirtes elissa** Godman

Biol. Cent.-Amer., Rhop., pl. 95, fig. 41, (1900).

This species was reported from Reef, Cochise County, Arizona (Skinner, Ent. News., XV, p. 344, (1904). A genitalic examination of the specimen shows it to be *nanno* and not *elissa*. It is a small individual and agrees well with the Biologia figure of *elissa* (pl. 95, fig. 40), but *elissa* appears to be different genitalically, the aedoeagus being like the typical series of *Amblyscirtes*. The name should therefore be eliminated from our faunal lists.

28. **Amblyscirtes carolina** Skinner (Fig. 28.)

Upperside. Primaries fuscous with three small subapical yellow spots, the upper one small; two yellow spots about the middle of the cell and a row of four yellow spots extending across the wing from middle nearly to the interior margin.

Underside. Primaries with spots repeated. Secondaries brownish yellow, distinctly spotted with dark brown dots.

Type locality; Hamlet, Richmond County, North Carolina, August (Jones).

The pattern of the markings indicates that this species belongs in *Amblyscirtes* and the male genitalia are almost the same as *rialis*.

Records: NORTH CAROLINA, Raleigh, April (Brimley); GEORGIA, Atlanta (Fiske).

29. **Amblyscirtes oslari** Skinner (Fig. 29.)

Upperside. Light brown, a faint golden tint to the surface of the wings and sometimes some faint spotting, of the usual pattern. Fringes dark gray, nearly concolorous with wing.

Type locality, Chimney Gulch, Colorado (Oslar).

Records: COLORADO, Chimney Gulch, May, Golden, May, Mill Gulch, May, Coal Creek, July (all Oslar); NEW MEXICO, Jemez Springs, June (Woodgate); TEXAS, San Antonio.

30. **Amblyscirtes (Mastor) bellus** Edwards (Fig. 30.)

Biol. Cent.-Amer., Rhop., pl. 100, figs. 36, (1900).

Upperside. Chestnut brown. Palpi and fringes orange.

Type locality, Southern Arizona (Morrison).

Records: ARIZONA, Cochise County, May (Poling); NEW MEXICO, Jemez Springs (Woodgate).

31. **Amblyscirtes (Mastor) phylace** Edwards (Fig. 31.)

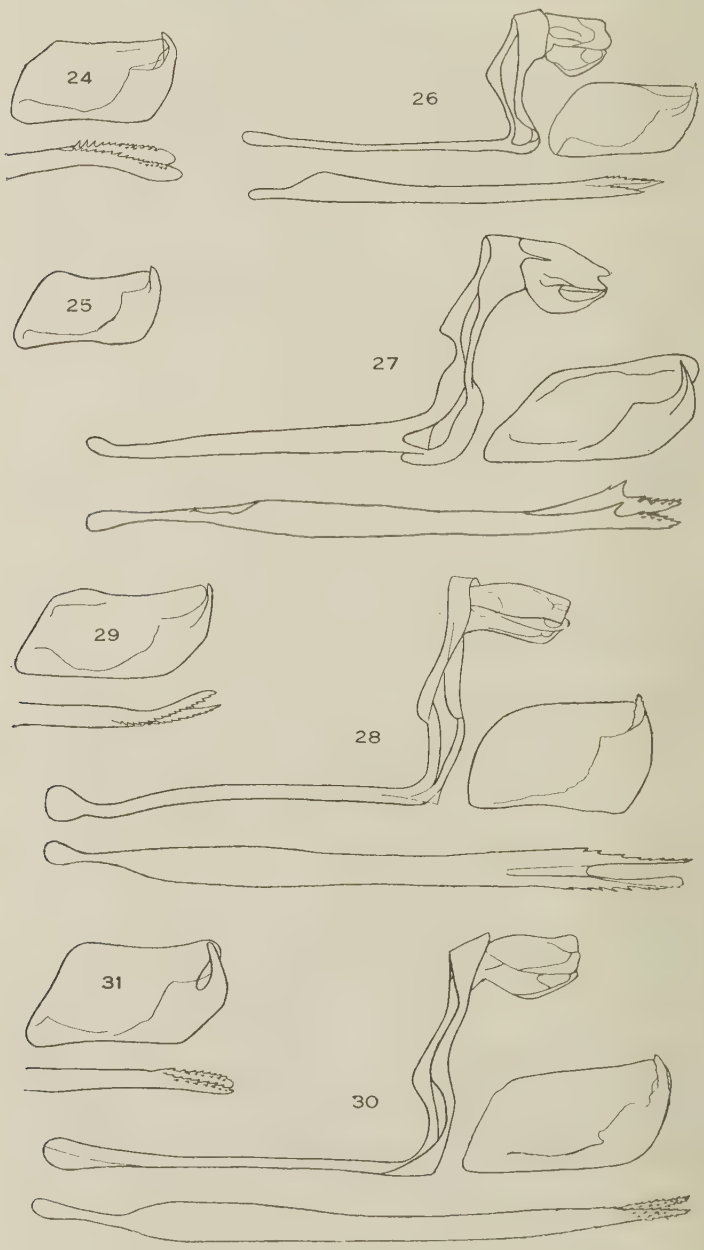
Upperside. Wings brown, palpi orange, fringes white.

Type locality, Southern Colorado (Morrison).

Records: ARIZONA, Cochise County, August (Poling); NEW MEXICO, Jemez Springs, May, June (Woodgate), Rincon, June.

32. **Lerodea fusca** Grote and Robinson (Fig. 32.)

This species is, as the name implies, fuscous on all wings. Some specimens are very dark, some have ocher scaling on the secondaries below, and some have some indications of spots on the primaries above. The fringes are gray.



24. *Amblyscirtes celia*, Corpus Christi, Texas. 25. *Amblyscirtes aenus*, Jemez Springs, New Mexico. 26. *Amblyscirtes cassus*, Arizona. 27. *Amblyscirtes nanno*, Arizona. 28. *Amblyscirtes carolina*, Atlanta, Georgia. 29. *Amblyscirtes oslari*, Jemez Springs, New Mexico. 30. *Amblyscirtes* (*Mastor*) *bellus*, Cochise County, Arizona. 31. *Amblyscirtes* (*Mastor*) *phylace*, Jemez Springs, New Mexico. (All × 18.)

Type information: Atlantic District, Georgia, Florida.

The uncus is split at the end, the two lobes rounded and below these there are two spatulate projections; the saccus is extended in a slender tube. The valve ends in an upturned ventral lobe the dorsal edge of which is serrate and straight. The aedoeagus is rather long and carries internally a branch swollen at the outer end and terminating in a double tooth. At the end of the aedoeagus there is an external tooth.

Records: GEORGIA, Tifton, May, September (Pilate), State College (Fiske); FLORIDA, Central Florida (Morrison), Sanford; ALABAMA, Mobile (Dukes); ARKANSAS, Hope, June, July, August (Knoebel); TENNESSEE, Nashville, August; NORTH CAROLINA, Wilmington, May, June; PENNSYLVANIA, Philadelphia, August (Skinner), Elwyn (Wells), Mount Airy, August (Laurent), Castle Rock, June (Skinner).

33. **Lerodea neamathla** new species (Fig. 33.)

Male. Expanse, 11 mm., female, 13 mm. (one wing).

Upperside. Primaries brown with three very faint, linear, subapical spots. Two faint spots on the center of the wing, the lower one not in line and nearer the center of the wing. Under a lens these spots are composed of lighter colored scales on the darker background of the wing. Secondaries brown and immaculate.

Underside. Primaries with the median spots repeated. Secondaries light brown, immaculate.

Antennae above fuscous with the apiculus red brown. Underside with the shaft annulated.

Palpi yellowish white with white scales interspersed. Pectus clothed with sordid white hairs; legs brown.

Described from a male type and a female allotype, and two male and a female paratypes.

The specimens were taken in Central Florida in 1884 by H. K. Morrison, and are in the collection of the Academy of Natural Sciences of Philadelphia.

The species is exceedingly close to *Lerodea fusca*, and in fact we have not found any absolute characters to separate them other than the genitalic ones.

The uncus ends in a pair of widely separated arms, rounded at their apices, and just below them a pair of upturned similar projections. The saccus is rather long and slender. The valve

ends in two distinct lobes, the dorsal one spatulate, prominent and serrate on its straight outer margin, the ventral one rounded. The aedoeagus carries an internal branch, and at the end an external tooth.

The uncus is more like that of *arabus* than that of *fusca*, and the valve differs from that of either of these species.

In all of the species of *Lerodea* which we have treated the juxta is a mere slender ring.

The species is named for the Seminole Chief Neamathla or Neah-Emathla, who ruled the tribe from 1824 to 1836.

34. **Lerodea arabus** Edwards (Fig. 34.)

Upperside glossy dark brown; primaries have three small spots on costal margin in a straight transverse line, and two oblique to them in median interspaces, all translucent. A whitish point in submedian interspace in line with the two spots and a similar point in cell near outer end.

Underside. Secondaries with a brown area on middle of disk and to costal margin.

Type information, Southern Arizona.

The uncus is similar to that of *neamathla*, but the terminal lobes are rather more slender. The valve ends in two lobes, the dorsal one rounded, the ventral one sharply pointed and somewhat toothed. The aedoeagus bears an external double tooth at the end.

35. **Lerodea eufala** Edwards (Fig. 35.)

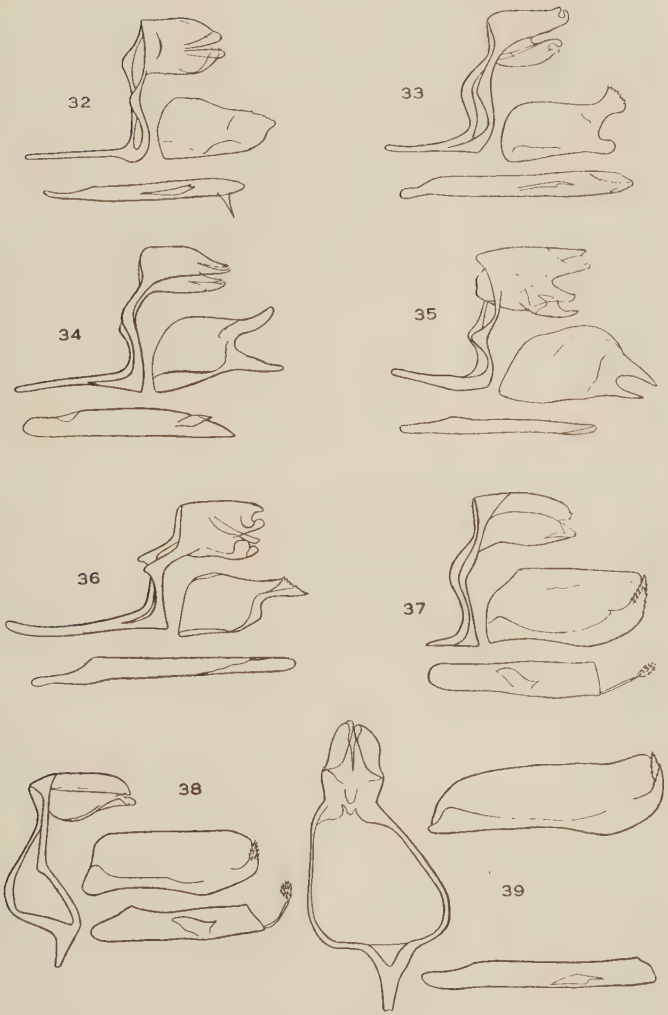
Biol. Cent.-Amer., Rhop., pl. 95, fig. 18, (1900).

Upperside. Primaries olive brown with three semi-transparent dots in a line from the costa near the apex and two small spots below and anterior, separated from the others by the space of a line.

Type locality: Apalachicola, Florida.

The uncus is similar in structure to that of *arabus*, but it is stouter and the lower projections are rather more removed from the upper ones. The valve ends in two projections each of which is pointed with a strong tooth. The aedoeagus seems to lack the teeth present in our other species, or at least they are only slightly developed.

Records: FLORIDA, Chokoloskee, Miami, January (Hebard), November (Porter), Georgiana, Indian River, July, Egmont,



32. *Lerodea fusca*, Philadelphia, Pennsylvania. 33. *Lerodea neamathla*, Central Florida. 34. *Lerodea arabus*, Arizona. 35. *Lerodea eufala*, Mexico. 36. *Lerodea tripunctus*, Paramaribo, Dutch Guiana. 37. *Prenes panoquinoides*, Corpus Christi, Texas. 38. *Prenes errans*, California. 39. *Prenes panoquin*, Anglesea, New Jersey. (All × 15.)

April; GEORGIA, Thomasville, January (Hebard), Shoulder, October; TEXAS, Round Mountain, November (Schaupp), San Antonio, Corpus Christi (Aaron); CALIFORNIA, Indian Wells, October (Coolidge); NEBRASKA, Omaha, October, Greenwood, October, Blair, November (all Leussler). CUBA, Guantanamo, August (Ramsden), Rincon (Williams).[9]

36. **Lerodea tripunctus** Herrich-Schaeffer (Fig. 36.)

Mr. E. L. Bell has shown us a specimen in his collection bearing the label "Florida," without further data, and there is another in the collection of the Academy of Natural Sciences of Philadelphia, with a similar label. While this evidence of the occurrence of *tripunctus* in our fauna is not conclusive, it is not unlikely that this Cuban species should be found as a stray in southern Florida, and we are therefore adding the name to our list.

Upperside. Primaries dark brown with (usually) three subapical dots and (usually) three below them in a transverse line. This species is darker in color than *eufala* and the antennae are longer.

Type information, Cuba.

The uncus has the four projections as in the other species of the genus. The valve ends in a spatulate projection serrate on the outer margin and this in nature is curved or fluted, so that when pressed down by the cover glass of the slide it assumes different positions and aspects.

Records: CUBA, Guantanamo, February (Skinner), August (Ramsden); JAMAICA; DUTCH GUIANA, Paramaribo.

37. **Prenes panoquinoides** Skinner (Fig. 37.)

This species was described from insects from Key West, Florida, and Texas (Morrison). We now designate as the type a male from Key West, Florida. Specimens have a rather golden sheen to the wings above. The males usually have three fine spots, two subapical, and one below on the primaries, though

[9] *Cobalus dispersus* Gundlach (H.-Sch. Mss. (355)), Ent. Cubana, I, p. 154, (1881), is synonymous with *Lerodea eufala*. We have one specimen, No. 69 of the Poey Collection, now in the Academy of Natural Sciences of Philadelphia, which is identical with specimens from Florida, as well as those from Guantanamo, Cuba (Bamsden).

there may be a few more small spots, or all may be obsolescent; the secondaries are immaculate. On the secondaries below there are three somewhat elongated white spots, one towards the costa, and two, together, central. The females have more and larger spots on the primaries above.

The pattern of the tegumen and valvae is very much the same in all of our species of the genus *Prenes*. The short stout aedoeagus in *panoquinoides* and *errans* carries an internal lobe ending in a single tooth and in addition there is a small floating bristling tuft, normally within, but often found outside of the end of the aedoeagus.

Records: FLORIDA, Key West (Morrison), Miami, February, March (Hebard); TEXAS, Corpus Christi (Aaron); YUCATAN, Progreso, November, December (Williams).

38. **Prenes errans** Skinner (Fig. 38.)

The type information is California. This is very close to *panoquinoides*, but we treat it as a species rather than a racial form, as it can be distinguished by the greater number and larger size of the spots on the primaries above, which usually include a streak above the middle of the inner margin not present in the males of *panoquinoides*, while the secondaries below show three and usually more spots, not white as in *panoquinoides*, but yellowish and drawn out into streaks parallel with the veins.

The genitalia are the same as *panoquinoides*.

Records: CALIFORNIA, Santa Monica, July (Grinnell), Pasadena, September, San Diego, July.

39. **Prenes panoquin** Scudder (Fig. 39.)

It is larger than the preceding species, and the secondaries below have the venation outlined in a lighter color and there is a white streak from the end of the cell extending nearly to the outer margin.

The aedoeagus carries the lobe and tuft present in *panoquinoides* and *errans*.

Records: FLORIDA, Osprey, March; MISSISSIPPI, Gulfport; NEW JERSEY, Anglesea, June, August (Skinner), Corson's Inlet, July (Williams).

40. **Prenes ocola** Edwards (Fig. 40.)

Biol. Cent.-Amer., Rhop., pl. 90, fig. 18, (1900).

Ocola is usually immaculate on the secondaries below, but sometimes there are indications of the spots present in *sylvicola*, and it may be that they are but racial forms of one species.

The terminals of the uncus are but slightly different from those of the preceding species. The aedoeagus carries the lobe with a single tooth (in specimens from our fauna), but the floating tuft, present in the preceding species, is absent.

Records: FLORIDA; Miami, February (Williams); GEORGIA, Tifton, September (Pilate); TEXAS, San Antonio; PENNSYLVANIA, Cobb's Creek, Philadelphia, September (Aaron).

41. **Prenes sylvicola** Herrich-Schaeffer (Fig. 41.)

Biol. Cent.-Amer., Rhop., pl. 96, fig. 4, (1900) (as *nero*).

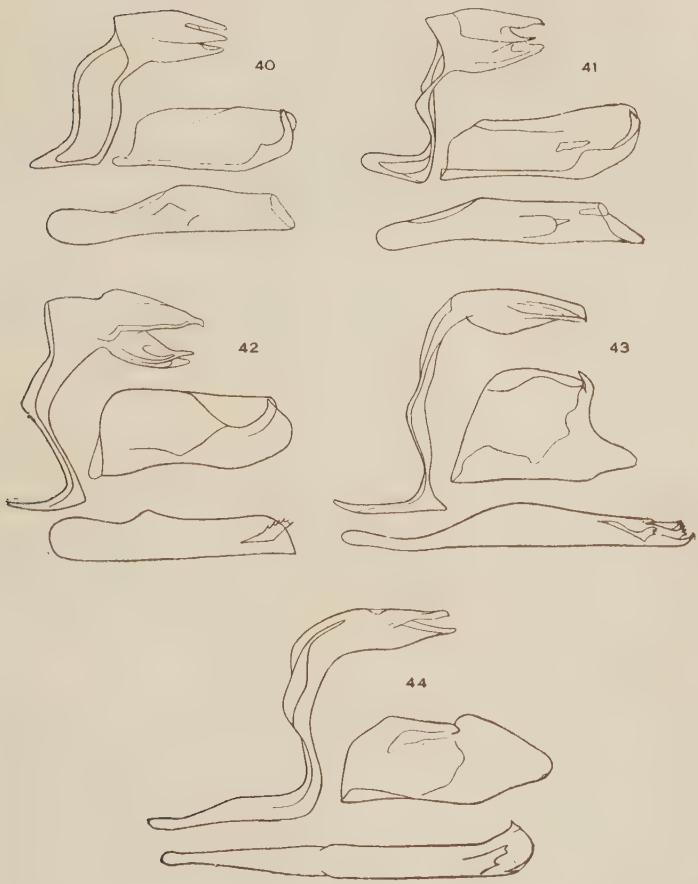
Godman in the Biologia places *sylvicola* as a synonym of *nero* Fabricius, figuring rather typical *sylvicola*, however, on plate 96-figs. 5 and 6 (♀). The figure of *nero* in Butler's Catalogue of Fabrician Diurnal Lepidoptera (plate 2, fig. 13) and the description does not correspond with the above figures and Herrich-Schaeffer's description, in that in *nero* there is a distinct broken white band on the secondaries below, and we believe that Butler's figures should be taken as typical of the Fabrician species.

Sylvicola has a row of small spots on the secondaries below and the apices of the primaries and three-fourths of the secondaries below are usually suffused with a blue sheen, which also gives the spots a bluish cast. Often the bluish sheen is absent and it may fade out in old specimens, in which case the spots are sordid white.[10]

It may be that *nero* and *sylvicola* are one species, *nero* being an intermediate form between *corrupta* Herrich-Schaeffer (with

[10] This has been named *Hesperia fusina* Hewitson (Descriptions of One Hundred New Species of Hesperidae, II, p. 30, (1868)), which has on the underside "posterior wings crossed beyond the middle by a narrow band of lilac-white spots." This is from the Amazon (Santarem).

Records: CUBA (Poey Collection); JAMAICA; HAITI, Port au Paix, July (Abbott); SANTO DOMINGO (Frazer); ANTIGUA, English Harbor, October (Rhoads); MARTINIQUE, St. Pierre, December (Geddes); GRAND CAYMAN ISLAND; PANAMA, Canal Zone, June (Harrower); ECUADOR, Huigra, March (Rhoads); BRAZIL, Corumbá, Chapada.



40. *Prenes ocola*, San Antonio, Texas. 41. *Prenes sylvicola*, Haiti. 42. *Calpodes ethlius*, Florida. 43. *Calpodes coscinia*, Guantanamo, Cuba. 44. *Thespieus macareus*, Chapada, Brazil. (All × 13.)

broad white band below) and typical *sylvicola*, but this has not been proved, and Mr. Ramsden has not found connecting forms in Cuba.

For this reason we retain the name *sylvicola* for the Cuban insect, as in any event the name should be retained for the insular race, and it is this form which has been recorded from Florida, perhaps an immigrant from Cuba.

The entire structure of the genitalia seems to be the same as that of *ocola*.

Records: CUBA, Guantanamo, August (Ramsden); HAITI, Port au Paix (Abbott); JAMAICA; COLOMBIA, Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, July (Hebard).

42. **Calpodes ethlius** Cramer (Fig. 42.)

Biol. Cent.-Amer., Rhop., pl. 95, fig. 46, (1900).

The genitalia, including the shape of the valvae, are similar to those of the genus *Prenes*.

Records: FLORIDA, Miami, February, March, July (Hebard), (Laurent), (Williams), Palm Beach, February (Hebard), Gulfport, June (Reynolds); SOUTH CAROLINA, Charleston; TEXAS, Corpus Christi (Aaron); JAMAICA; PARAGUAY, Villa Rica (Jorgensen).

43. **Calpodes coscinia** Herrich-Schaeffer (Fig. 43.)

Biol. Cent.-Amer., Rhop., pl. 96, fig. 12, (1900) (as *ares*).

This species has been recorded as *ares* from Cochise County, Arizona,[11] and there are Texan records. The two names may be conspecific but the description of *ares*[12] is not very definite, and according to Godman the type is lost, so we use the Herrich-Schaeffer name as applicable to the species found in our fauna.

The uncus is similar to that of *ethlius*, but the valve is quite different. The aedoeagus in these two species carries several toothed lobes at the terminus.

Records: CUBA, Guantanamo, August (Ramsden); JAMAICA.

[11] Skinner, Ent. News., XIII, p. 183, (1902).

[12] *Hesperia ares* Felder, Verh. zool-bot. Gesellschaft, Wein, XII, p. 477, (1862).

44. **Thespieus macareus** Herrich-Schaeffer (Fig. 44.)
Biol. Cent.-Amer., Rhop. pl. 96, fig. 43, (1900).

The tegmen is similar to that of the preceding species, the valve, however, is quite different from either of them. The aedoeagus bears some toothed lobes at its terminus.

Records: FLORIDA, Marco Island; MEXICO, Texola; HONDURAS, San Pedro Sula (Lienhart); COLOMBIA, Cauca (Bonis), Neiva; PANAMA, Chiriqui; BRAZIL, Chapada; PARAGUAY, Sapucay (Foster).

BIOLOGY OF SCYMNUS NUBES CASEY

(COLEOPTERA; COCCINELLIDAE)

BY W. M. DAVIDSON[1]

U. S. Bureau of Entomology, Vienna, Va.

Scymnus nubes, originally described[2] from Arizona (Yuma), is abundant in the Imperial Valley of California and is presumably native therein.

During 1918 and 1919 the writer frequently observed it in grain, milo maize and cotton fields, preying on aphids (*Aphis maidis* Fitch, *Aphis prunifoliae* Fitch, *Aphis gossypii* Glover). The insect made its appearance in March and was active until the end of the year, a few larvae having been encountered as late as the last week of December, 1918. There is a hibernation period in December, January and February. In the field the adult beetles, eggs and larvae are found among aphid infestations; the mature larvae usually leave the colony of aphids and pupate on stubbles, pieces of wood, posts, boards, under papers and clods. The pupal stage is the one most frequently met with in casual observation.

The biologic records given below were compiled almost entirely from material bred at Sacramento, California, but the original stock was transported, June 26, 1918, from the Imperial Valley, in the same state. At Sacramento the summer temperatures are lower and the humidity higher than in the Imperial Valley, and it is certain that the species transforms more rapidly in the latter locality than in the former. No period of aestivation was observed.

The insects were reared in small glass vials provided with cotton and cheese-cloth stoppers.

Mating occurred within two or three days of adult issuance. In confinement copulation was rarely observed, unlike the habit

[1] Published with the permission of the Secretary of Agriculture.

[2] T. L. Casey; A Revision of the American Coccinellidae (Trans. N. Y. Ent. Soc., VII, p. 2, 1899).

of the larger Coccinellids where confined pairs are frequently observable in copulo.

There elapsed a varying period of time between mating and egg deposition. In twenty instances during August, September and October, 1918, this period varied from seven to thirty days, with an average of fourteen and four-tenths days. This is a longer lapse of time than commonly found in other Coccinellidae under laboratory conditions.

The oviposition record of fourteen females was recorded. An average of 31.5 ova were deposited in an average period (first to last egg) of 26.4 days; a laying average of six eggs to five days, or a little over an egg a day. During the earlier part of the oviposition period the females deposited about four eggs daily. On the whole the females oviposited in an erratic and uneven manner in captivity; they preferred to deposit on the stoppers and when the cotton was enclosed in a cheese cloth of wide mesh thrust the eggs through the cloth. Black cheese cloth showed up the eggs better than white and was used more frequently in consequence.

In nature the ova are deposited singly on the plants infested by the host aphids. In the vials they were always laid singly. The adult exhibits a marked tendency to place her eggs in protected situations; when beet leaves were provided the eggs were placed in folds of the leaf or under cast aphid skins. However, the favorite location was the cheese cloth of the stopper.

The ova are .4 mm. long and .25 mm. broad, short oval, varying in color from pale yellowish-green to dark amber, according to the food of the parent beetle; thus a female fed on a light green aphid, e.g. *Myzus persicae* Sulzer, deposited light-colored eggs, but if the food were changed to a black aphid, such as *Aphis rumicis* Linnaeus, the eggs following the change were dark amber-colored.

At Sacramento the incubation period varied from four to six days at midsummer, to ten days in October. At El Centro in May, five eggs incubated in five days, the temperature being about the same as that obtaining at Sacramento in July and August. Previous to hatching the egg darkens.

Infertility and mortality rarely occurred in the eggs under observation. Out of nine hundred and seventy-seven eggs, one

hundred and eighty-three were not followed beyond the deposition date. The remaining seven hundred and ninety-four hatched, all except seventeen which were infertile and seven fertile individuals which died before hatching. Therefore but three percent failed to hatch.

The newly-hatched larva is pale amber; head and legs yellow, soon becoming gray; in shape somewhat narrow. A few hours after hatching the characteristic white woolly threads are excreted from the pores on the derm. Each segment bears six pores. The larva is .5 mm. long and .2 mm. broad. The woolly threads grow as the instar proceeds and are cast with the molt. Newly-molted larvae in the second instar measure 1.55 by .5 mm., are light yellowish-gray, elongate; the head dark gray, knees grayish. After the second molt the larva is 2.1 by .75 mm., light greenish-yellow, the head olive-gray, legs gray, eyes black; form elongate, neck constricted. After the third molt the fourth instar larva measures 3.2 by 1.2 mm. and at maturity 4.2 mm. long and 1.45 mm. wide; at first light emerald green, with gray legs, greenish-gray head and black eyes; towards the end of the instar the general color becomes light yellow. Individuals fed on dark-colored aphids are yellowish-brown. A pair of gray impressed spots occur on the dorsum of each thoracic segment. The woolly threads, which conceal the body of the larva, in the older stages have an indistinct bluish-gray shade, becoming sordid white the last day of each instar. The longest dorsal threads are erect or somewhat recurrent, about two-thirds as long as the larva is wide. The lateral threads are shorter and stand out horizontally. The full-grown larva appears less elongate than the younger stages, about three times as long as wide and slightly flattened.

The larvae have short legs, but are active and move with agility. They grasp their prey always by an appendage, generally the middle tibia of the aphid, and drain out the body juices from that point. Except when full-grown and ready to transform they prefer places of concealment.

Examination of mounted larval exuviae shows that the larvae bear an armature of spines: On the head is a transverse row of ten long spines and there are about forty-four shorter ones on this sclerite. The prothorax bears five long spines on

each side and some fifty shorter ones on the sides and anterior half; the longest spines on this sclerite are stouter but not quite as long as those of the head. The mesothorax bears on each side three long spines and thirty shorter ones; the metathorax on each side two long and twelve short spines. Each thoracic sclerite has a pair of short ventral median spines. Each abdominal segment bears a transverse circular row of fourteen stout spines, the longest of which are similar to the lateral spines of the thorax. The hypopygium has eight long and twenty short spines. Each leg bears some fifty hairs distributed all over.

Aphids are the normal food of the larva. In the Imperial Valley larvae were observed to feed on *Aphis maidis* Fitch and *Aphis gossypii* Glover. In confinement they readily ate *Myzus persicae* Sulzer, *Chromaphis juglandicola* Kalt., *Rhopalosiphum nervatum* Gillette, *Mysus rosarum* Walker, and *Aphis rumicis* Linnaeus, the last a dark species.

Two larvae during their cycle of eleven days consumed a total of eighty-nine *M. persicae* in the third instar. Another larva ate fifty-nine similar aphids during its two last instars. Three other larvae ate a total of ninety-eight *M. persicae* in the fourth (penultimate) instar during the four days of the last instar of the coccinellids, an average of almost thirty-three aphids per larva, or eight per day per larva. Again three larvae during their last instar of five days consumed one hundred and twelve *M. persicae* in the third instar, an average of about thirty-seven aphids per larva, or 7.4 per day per larva.

It is concluded that during its larval stage the insect eats from forty to fifty aphids of the size of the fourth instar. The run of an average aphid colony is below this average size and therefore the *Scymnus* larva probably devours about eighty to one hundred aphids normally.

When mealy-bugs were offered as food the larvae attacked them, with the result that their jaws became clogged with the drying juices of the scale and the coccinellids died.

A total of one hundred and sixty-six larvae were reared in captivity; fifty-one of which, hatched in July, passed through a larval stage averaging eighteen days (fifteen to twenty-two);

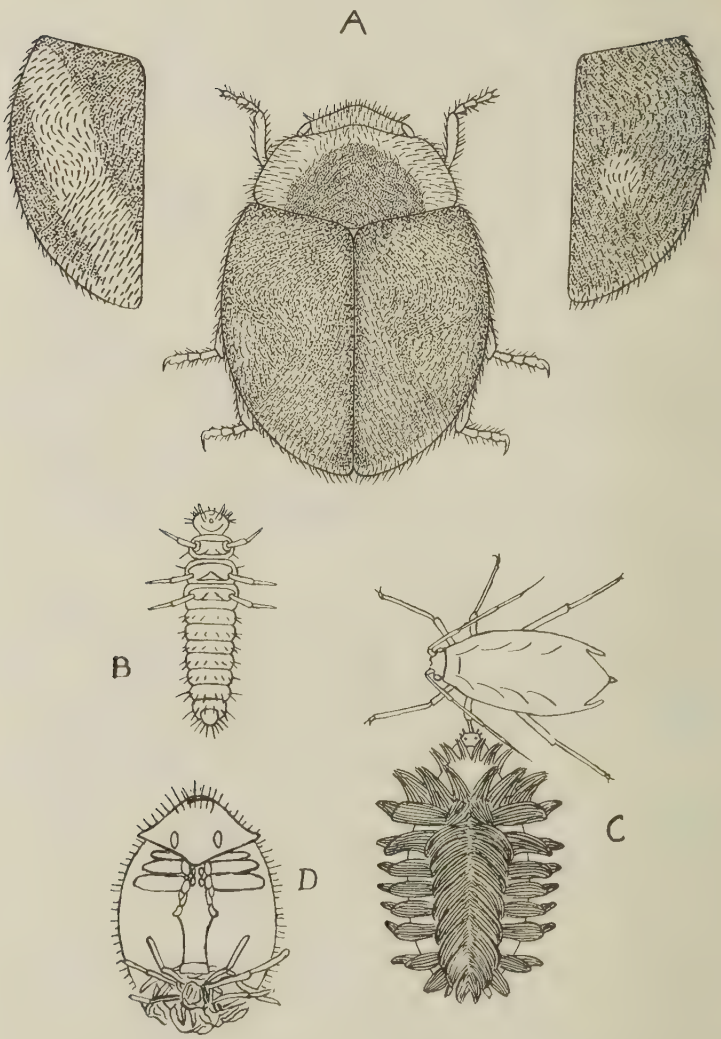
forty-five in August averaging 21.6 days (eighteen to twenty-eight); thirty-eight in September averaging 24.3 days (twenty to thirty-eight); twenty-eight in October averaging 24.5 days (twenty to twenty-eight). With seven exceptions all these one hundred and sixty-six larvae developed on the green peach aphis (*Myzus persicae* Sulzer).

Four larvae which hatched in May and were reared at El Centro passed the larval stage, three in fifteen and one in thirteen days.

Records show that the duration of the four larval instars was in the following ratios: 5.3.3⅓. 10½, or in average of days 3.4, 2.2, 2.4, 7.1. Therefore the final instar is considerably the longest, twice as long as the first and about three times as long as either the second or third. The duration of the final instar includes the period, about twenty-four hours, between the 'tailing' of the larva and the casting of the skin. During the warmer part of the year the second and third instars were frequently passed in less than twenty-four hours, and on one occasion the first instar occupied less than one day. The exuviae are sordid white or light grayish.

Upon attaining its full size the larva attaches itself by the cauda to the surface of the object upon which it will pupate. In due time the skin splits and the pupa discloses itself. The pupa is 2.2 mm. in length, 1.25 mm. in width, and .85 mm. in height. It is short oval, yellowish-brown or dark amber, armed with short black and fulvous hairs which are most numerous on the sides and posterior margins of the head and prothorax. The venter, head and legs are pale yellow; the eyes very small and black. The pupa is partially, sometimes wholly, hidden beneath the woolly threads shed by the full-grown larva at the time of transformation. It secretes no such substance itself.

The pupal instar was observed in one hundred and sixty instances: thirty-six individuals pupating in July averaged 6.17 days (four to eight); thirty-two pupating in August, 6.37 days (five to fifteen); thirty-three pupating in September, 8.7 days (five to fourteen); thirty-eight pupating in October, 12.1 days (seven to twenty-one); and seventeen pupating in November, 29 days (twenty-one to thirty-four). At El Centro four individuals pupating in June averaged 3.75 days.



Scymnus nubes Casey. Fig. A.—Adult beetle, immaculate form; single elytra to show spotted and striped forms. Fig. B.—Ventral view, newly molted larva, third stage. Fig. C.—Larva in last instar, to show characteristic manner of grasping aphid by middle tibia. Fig. D.—Ventral view of pupa. Fig. A is drawn on a much larger scale than figs. B to D.

The adult remains for several hours under the pupal skin after it transforms. It is light brown in the teneral stage and does not obtain the full color for about two days.

Examination of the pupal case shows that the head bears a dorsal row of twenty spines on the posterior margin and about thirty smaller spines on the disc and anterior margin; the prothorax bears twenty-four spines on each lateral margin and twenty on the posterior margin besides many smaller on the central portion; the wing pads bear a row of thirty-two spines on the outer and a row of twenty on the inner margin; on the central portion of the mesothorax are many small spines, while the metathorax has forty-eight short spines; each abdominal segment bears a transverse row of short spines near the posterior border; segments one to six inclusive have in addition about twenty longer spines arranged in lateral groups; the third and fourth segments each have on the inferior surface a pair of dorso-lateral blunt wart-like protuberances armed with short hairs; the caudal segment is medially produced bifurcate.

The pupa case is sordid yellow; the spines black, on the dorsum fulvous. Extended it is 3.25 mm. long and 1.65 mm. wide.

The adult beetles are oval and convex and not highly polished. They vary in length from 1.8 to 2 mm., and in maximum width from 1.25 to 1.45 mm. The head and antennae are reddish-brown; the pronotum similar with a parabolic basal black spot; the elytra vary considerably in pattern, there is always a rather ill-defined apical testaceous spot, the disc is either immaculate or bears a yellowish-red maculation varying from a small subcentral spot to a broad slightly oblique vitta which may occupy half of the area of each elytron. In breeding there appeared a tendency to immaculation; immaculate parents always produced immaculate progeny, while the progeny of striped and spotted parents was occasionally spotless. The legs are testaceous, the coxae and four posterior femora except the knees black. The hind femora are enlarged. The elytral punctuations are fine and close-set, and the pile is light fulvous.

Records were made of the feeding habits and capacity of the adult beetles. A male issued on September 6 was alive December 18. Between September 6 and November 26 it was offered *Myzus periscae* Sulzer. Calculations based on the number of

aphids offered, the number removed alive at feeding time and the mortality in the check cage indicated that the beetle disposed of 3.1 aphids daily in September, 1.7 in October, and .4 in November. These aphids averaged the size of the fourth instar.

Another male issued October 13. During October it consumed a daily average of 2.35 fourth instar aphids (*M. persicae*); during the first twenty-six days of November the average dropped to .6 per day.

A female issued October 13. During the balance of this month it consumed 2.45 fourth instar aphids (*M. persicae*) daily. During the first twenty-six days of November, .85 per day were eaten.

Another beetle between September 1 and 24 consumed a daily average of 3.85 fourth instar *M. persicae:* A fifth individual between August 26 and September 23 consumed 3.3 fourth instar aphids (*M. persicae*) daily.

It appeared therefore that the adult beetles eat a daily average of not over 4 aphids in the fourth instar. In the aphid colony the average size of the individuals is smaller than, this and therefore it is reasonable to believe that the beetles dispose of at least eight aphids of average size each day.

The beetles grasp the aphids at any part, perhaps most often in the region between the cornicles. Aphids were observed to escape after a beetle had gnawed off an appendage or even eaten a hole in the derm.

When offered a diaspine scale (*Aspidiotus* sp.) the beetles readily fed on it if the "armor" had been removed and the soft body exposed; when the scales were offered with their "armor" intact the beetles did not successfully attack them.

In confinement the adults were never observed to attack each other or the immature forms, but the larvae occasionally attacked and killed their fellows.

The beetles are remarkably long-lived. With a normal supply of food the females lived for about four weeks after the last ovum was deposited. Two females lived for ten weeks sterile; one of them died after an adult existence of one hundred and thirty days (August 3 to December 11), the other was alive one hundred and three days after having transformed from the pupa and was mounted for the collection December 19.

Ten beetles issuing during October were kept without food; they remained thus alive for from five to seventeen days, their average longevity in the adult stage being ten days.

Twenty-one beetles issued between November 7 and December 10. None of these were provided with food. Three died after an average adult longevity of twelve days; the other eighteen were subsequently placed in a hibernating cage after having been in the adult stage an average of fourteen days. One of these was alive twenty-five days, two others twenty-two days, after their issuance.

This second lot experiencing ower temperature enjoyed a considerably greater adult longelvity than the first. It appeared that most of them were ready for hibernation as soon as chey had transformed, while all the beetles of the earlier lot died through starvation, conditions for hibernation not being present so early in the season.

The sexes were found to be in the ratio of four females to three males.

Unmated females deposited a few ova which soon collapsed.

The period of development from egg deposition to adult issuance varied from twenty-two days in midsummer to sixty-one days in late fall. Considering the adult female to have a preoviposition period of fourteen days, the minimum generation period at Sacramento was about thirty-six days. This time is doubtless shortened in the arid native localities of the insect.

STUDIES IN THE DERMAPTERA AND ORTHOPTERA OF COLOMBIA

THIRD PAPER

Orthopterous Family Acrididae

BY MORGAN HEBARD

In studying the grasshoppers of Colombia it was found necessary to locate as many of the known South American genera as possible. Much could be accomplished, as large unstudied collections were available from Ecuador, Peru, Venezuela, Trinidad, the Guianas, Brazil and Bolivia, while large collections have already been reported on by Rehn from Brazil, Paraguay and the Argentine. Examination of all available material and careful comparison with the literature, particularly the contributions of Stål, Gerstaecker, Giglio-Tos, Bruner and Rehn,[1] alone made it possible to locate many of the Colombian forms and to make satisfactory comparisons.

The fact that the Acrididae of South America have not been monographed in recent years[2] makes the literature particularly difficult to deal with. Stål's "Recensio Orthopterorum" covered all the species known to that author and included a complete generic key. Unfortunately, however, there are no accompanying figures, while the descriptions of new genera and species are often very incomplete, when comparison with the many subsequently described forms is desired.

In the Acrydiinae, reference to the Hancock Collection, now a part of the author's collection, greatly facilitated the work on this difficult subfamily.

The great richness of the Colombian fauna is evident. This is largely attributable to the fact that probably no country in South America includes so many diverse areas of great extent,

[1] To a less degree the studies of Brunner, Scudder, Bolivar and Hancock.

[2] Burr's study of the Eumastacinae is the only work of this kind. The lack of sufficient material, unsatisfactory figures and superficial character of that work left much to be desired.

each wholly or in part separated from those adjacent by decided geographic or climatic barriers, and many of these teeming with the myriad of peculiar forms usually found in the humid tropical areas of the earth. Thus the tropical fauna of the Atrato and San Juan (The Chocó), of the Cauca, of the Magdalena and of eastern Colombia at the foot of the Andes, in each case includes to different degrees a peculiar fauna, while the same is true of the intervening mountain masses and of the arid tropical northern coastal strip. It is this geographic diversity which accounts for the fact that, though very many species have in the past been described from Colombia, the percentage of new forms in the collections now being studied is very high.

In studying the fauna of Colombia, one fact must be remembered. A large majority of the many species which have been described from "Bogotá," never came from that city or its immediate vicinity. In the early days Bogotá was the headquarters of professional collectors, whose most accessible and richest collecting grounds were in a tropical environment, at or near the eastern base of the Andes (near Villavicencio or Muzo) or on the upper Magdalena river. The material secured was indiscriminately labelled "Bogotá" in almost all cases. In tabulating the species found in the various faunistic areas of Colombia, this error must be remembered in order to obtain anything like accurate results.[3] It must also be remembered that the "Nova Granada" of early authors included both Colombia and Panama, though the latter was sometimes referred to as "Darien" or "Veragua."

The irregular and non-geographic boundaries of the Colombian states must also be remembered. The state of Antioquia includes sections of the Magdalena Valley, the Cordillera Central, the Cauca Valley, the Cordillera Occidental and the Chocó. Thus Andagoya, Antioquia, and Boca Murindó, Intendencia del Chocó, are adjacent and similar localities, separated by several distinctive faunistic areas from the city of Antioquia.

The collections before us include a large representation from the region of the Sierra Nevada de Santa Marta,[4] a large collec-

[3] In 1913, such material, representing five species, belonging to the Carnegie Museum, was recorded as from Bogotá, by Bruner, without comment. Ann. Carnegie Mus., VIII, pp. 461, 467, 488 and 489.

[4] The greater portion of this, collected by Rehn and Hebard, will be comprehensively studied at a later date.

tion from Villavicencio and its vicinity, good series from the Chocó, the eastern portions of Santander, the arid strip of Atlantico and the vicinity of Bogotá, as well as very many small lots from localities generally scattered over the country. Though representing considerably more material than previously recorded, we recognize the fact that many of the distinctive faunistic areas in Colombia still are known from only a few scattered records. In this richly diversified country great numbers of unknown species will undoubtedly continue to be found.

The constant accession of additional material since the publication of our first[5] and second[6] papers has resulted in important additions to the series available for study from central Colombia. Nothing, however, is known, nor have we any material, from the Cordillera de Baudo or the Black Andes. Southern Colombia, south of the latitude of Cali, is represented by only a few specimens, and all that is known of tropical eastern Colombia is from localities at or very near the base of the Andes as far south as Villavicencio.

In the present paper one thousand two hundred and sixty-four specimens are recorded, representing sixty-one genera, ninety-six species and one subspecies, of which nine genera, forty-seven species and one subspecies are new.[7] As previously noted for these collections, the material is in the Hebard Collection at the Academy of Natural Sciences of Philadelphia, unless otherwise indicated. To the Colombian material belonging to the Academy of Natural Sciences of Philadelphia and the United States National Museum, has been added for study a small series belonging to Cornell University. Ridgway's "Color Standards and Nomenclature" has been used to indicate the exact coloration, as is our custom.

[5] On Dermaptera, Blattidae, Mantidae and Phasmidae. Trans. Amer. Ent. Soc., XLV, pp. 89–179, (1919).

[6] On Dermaptera, Blattidae, Mantidae and Phasmidae. Trans. Amer. Ent. Soc., XLVII, pp. 107–169, (1921).

[7] In addition a new name is proposed for a Costa Rican species, with which comparison was found to be necessary.

Acrididae

ACRYDIINAE

Group *Lophotettigiae*

Lophotettix unicristatus Hancock (Plate X, figure 1.)

1909. *L[ophotettix] unicristatus* Hancock, Trans. Ent. Soc. London, 1908, p. 390. [♀, Colombia.]

Susumuco, Cundinamarca, October, 1918, (from A. Maria), 1 ♀.

The very high foliaceous crest of the pronotum and foliaceous antennal joints readily distinguish the species of this genus. In the present species this crest has its cephalic margin nearly vertical, concave, with a minute tooth mesad and with dorsal angle truncate. In the specimen before us the crest is undulate and attains a height of 3.7 mm., at the shoulders; caudad it diminishes gradually but somewhat irregularly in height, disappearing before the portion opposite the genicular areas of the caudal femora is reached.

Length of body (to apex of pronotum), 13; length of pronotum, 11.8; length of caudal femur, 6.1 mm.

We believe that the male from Demerara, British Guiana, described by Hancock in Bruner,[8] as *Gladiotettix unicristata*, represents a distinct species of *Lophotettix*.

Group *Metrodorae*

Allotettix peruvianus (Bolivar)

1887. *P[aratettix] peruvianus* Bolivar, Ann. Soc. Ent. Belgique, xxxi, p. 272. [♂, ♀; Pumamarca, Peru.]

1899. *Allotettix prolongatus* Hancock, Ent. News, x, p. 276. [Bolivia.]

After careful comparison of the type of Hancock's *prolongatus* with material from several Peruvian localities and with Bolivar's original description of *peruvianus*, we are convinced that the above synonymy should be established.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 10 ♂, 11 ♀, (4 caudate).

[8] Ann. Carnegie Mus., vii, p. 101, (1910). This specimen was recorded by Hancock as *Nephele unicristata*, but without description, at an earlier date (Gen. Ins., Fasc. 48, Orth., Tetriginae, p. 40, (1906)). The name *unicristata* therefore holds for the first described, the Colombian, insect.

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, XI, 1917, (M. A. Carriker, Jr.), 18 ♂, 28 ♀, 1 juv. ♀, (6 caudate).

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 1 ♀, (caudate).

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 2 ♀, (2 caudate).

The type of the Bolivian *A. americanus* Hancock, in the author's collection, shows that insect to be very closely related, the most conspicuous feature of difference being the decidedly narrower vertex.

In the abbreviate condition this insect has the median carina of the pronotum more distinctly developed and undulate than in the caudate condition, suggesting the very much more highly specialized type developed in the Central American *Chiriquia serrata* Morse.

The Colombian material averages smaller than the Peruvian. The smaller individuals in the latter series are, however, no larger than many of the Colombian examples. The Santander specimens are appreciably smoother than those from Magdalena.

Group *Acrydiae*

Paratettix toltecus (Saussure)

1861. *T[ettix] tolteca* Saussure, Rev. et. Mag. de Zool., (2), XIII, p. 401. [♂, ♀; "Mexico calida."]

1897. *P[aratettix] borellii* Giglio-Tos, Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, no. 302, p. 29. [♂, ♀; San Lorenzo and Caiza, [Ecuador].]

La Cumbre, Cordillera Occidental, El Valle, V, 19, 1914, (H. S. Parish), 2 ♀, [A. N. S. P.].

These specimens agree with numerous individuals before us from Mexico, Nicaragua, Costa Rica and Panama. They also fit perfectly Giglio-Tos' description of *borellii*, and from the evidence at hand we feel obliged to place that name in synonymy. The character of weak pronotal convexity, emphasized for *borellii*, is characteristic of the present insect.

Paratettix antennatus new species (Plate X, figure 2.)

Superficially this insect would appear to be a larger and more robust replica of *Micronotus caudatus* (Saussure).[9] Closer

[9] Comparison is made with a series from British Guiana.

examination shows it to differ decidedly in the frontal costa, which is less strongly produced and very feebly concave toward the fastigio-facial angle; the much weaker convexity of the median carina of the pronotum cephalad, and the ventral margins of the median femora, which are not produced in a small rounded lamella mesad. These species agree in having very elongate antennae, which are longer in *antennatus* than in any other American species of *Paratettix*.[10] The generic assignment is difficult. We have decided that *antennatus* is a species of *Paratettix* showing convergence toward *Micronotus*, while *caudatus* is a species of *Micronotus* showing convergence toward *Paratettix*.

The general contour of *antennatus* strongly resembles that of *P. frey-gessneri* Bolivar.[11] That species may, however, be readily separated by the much shorter antennae (♂, 3.2 mm.), less produced frontal costa and distinctly more convex surface of the pronotum between the shoulders. In the width of the vertex, forking of the frontal costa and contour of the femora these species agree closely.

Type.—♂; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 876.]

Size and form average for the genus. Surface microscopically tuberculate, with rugae on dorsum of pronotum subobsolete. Vertex moderately broad, in width equalling that of eye, cephalic margin transverse. Frontal costa narrow, expanding gradually to median ocellus and there equalling proximal antennal joint in width; in lateral aspect faintly concave below the broadly convex fastigio-facial angle, then broadly convex with point of greatest projection opposite antennal sockets. Antennae very elongate and slender (length 4.1 mm.). Pronotum (caudate) extending decidedly beyond apices of caudal femora,[12] dorsal surface flattened, showing very slight convexity between shoulders; shoulders distinct with more appreciable angulation than in *frey-gessneri*; cephalic carinae well developed, straight, feebly convergent caudad; median carina weakly cristato-arcuate near cephalic margin, then briefly subobsolete, thence fine but distinct and percurrent. Ventro-caudal angle

[10] No longer, however, than the antennae in certain Old World species assigned to this genus.

[11] Of which species a large Cuban series is before us.

[12] In the entire series the individual showing nearest approach to an abbreviate type has the pronotum extending to apices of the caudal femora.

of pronotal lateral lobes slightly less deflexed than in *freygessneri*, its ventral margin broadly convex, its apex sharply angulate at slightly less than a right angle. Tegmina represented by oval pads, in length about twice width, apex broadly rounded and dorsad in position. Wings fully developed, extending well beyond pronotum.[13] Median femora showing only very faint undulation of the dorsal and ventral margins. Caudal femora with rugae of external surface well defined and regular. Caudal metatarsus equal to the combined length of the two succeeding joints; its third pulvillus slightly shorter than the combined length of the first two, the apices of these pulvilli acutely spiniform.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Agrees closely with male, differing as follows. Size larger, form more robust. Vertex appreciably wider than eye. Antenna, 4.6 mm. in length. Dorsum of pronotum with small and very weak rugae. Ovipositor normal, moderately elongate.

General coloration dark chestnut brown, darkest on tegmina. Wings with costal margin heavily suffused with chestnut brown, remaining portions hyaline, iridescent, becoming rather strongly tinged with chestnut brown toward the peripheral margin. Tibiae triannulate with buffy. Caudal metatarsus with a suffused buffy annulus distad. Ultimate tarsal joints chestnut brown proximad, buffy mesad, blackish brown distad.

One male has the pronotum, except its cephalic margin, the tegmina and costal margin of the wings and caudal femora, except short proximal portion, blackish, the other portions being snuff brown. All of the females have a small velvety black post-humeral spot on each side, two of this sex having the dorsum of the pronotum elsewhere clay color. Two males show a distinctive marking which appears also in the series of *Micronotus caudatus* before us. These have on each side a band of clay color, running across the lateral lobes of the pronotum and converging to meet on the dorsal surface mesad above the bases of the caudal femora, thence longitudinal and causing the produced caudal portion of the pronotum to be entirely pale.

The measurements of the type and allotype are given first. Length of body, ♂, 7.7, 7.3 to 8; ♀, 9.7, 9.8 to 10: length of pronotum, ♂, 9, 9.5 to 10; ♀, 11.5, 11.2 to 12.2: greatest width of pronotum, ♂, 2, 2 to 2.2; ♀, 2.9, 2.8 to 2.9: length of caudal femur, ♂, 5.3, 5.3 to 5.3; ♀, 6, 6 to 6.2: length of ovipositor, 1.7, 1.8 to 1.8 mm.

[13] In less caudate individuals of the series extending no farther than the apex of the pronotum.

In addition to the described pair, eight male and eight female paratypes, bearing the same data, are before us, as well as a series of fifty-four individuals from Panama. We have strong evidence to show that this is the most abundant and most generally distributed tettigid in that country. Andagoya is a locality in the Colombian Chocó, where the insect probably occurs in a very similar environment.

Micronotus caudatus (Saussure)

1861. *T[ettix] caudatus* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 399. [♂, ♀; Guiana.]
1906. *Tettix gracilis* Bruner, Journ. N. Y. Ent. Soc., XIV, p. 145. [♂; [Island of] Trinidad, West Indies.]

Comparison of one of Bruner's paratypes of his "*Tettix gracilis*," with a series of Guianan individuals, convinces us of the synonymy indicated above.

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 1 ♂.

The pronotum in this specimen measures 11.6 mm. in length, 2.1 in width. The species is compared under *Paratettix antennatus* here described.

Acrydium andeanum new species (Plate XI, figures 1 and 2.)

The present insect is of particular interest, due to the fact that it is the first known valid South American member of this large genus,[14] known previously from North America, Europe, Africa, Asia and Australia.

Nearest affinity is apparently with *A. americanum* (Hancock)[15] described from "Boreal America." From that insect it differs in the wider and less produced vertex, with cephalic margin transverse in greater portion, the more acute fastigio-facial angle, the more distinct concavity of the frontal costa immediately below, when viewed from the side, and the slightly more rugose pronotal disk, which also narrows less evenly distad, showing there appreciable convexity of the lateral margins before they run straight to the acute apex.

[14] The genus constantly appears in the literature as "*Tettix*." Bruner's South American *Tettix gracilis*, however, we have just shown to be a synonym of *Micronotus caudatus* (Saussure).

[15] Comparison is made with a paratype in the author's collection, assigned by Hancock to his form *dimorpha* (which does not deserve nominal recognition).

The vertex itself shows less production than in any other species of the genus known to us.[16] The fastigio-facial angle (formed by the prominent median carina) projects distinctly beyond the eyes and is sharper than in many of the species of *Acrydium*.

Type.— ♀ ; La Pica, Santander, Colombia. Elevation, 9000 feet. February 10 to 15, 1917. (M. A. Carriker, Jr.) [Hebard Collection, Type no 877.]

Size medium and form robust for the genus, much as in the North American *A. hancocki* (Morse); surface granulate. Eye about two-thirds as wide as vertex. Vertex very weakly produced for this genus, its cephalic margin scarcely projecting cephalad of the eyes and nearly transverse, showing exceedingly weak convexity; the median carina there heavy and strongly projecting but rapidly weakening caudad on the dorsal surface of the vertex, which is decidedly concave on each side. In lateral outline the fastigio-facial angle thus projects distinctly beyond the contour of the eye, this angle being sharply rounded at slightly less than ninety degrees. Frontal costa expanding gradually and weakly to between antennae, then very weakly to median ocellus, its greatest width about one and one-third times that of proximal antennal joint. Frontal costa in lateral aspect weakly concave below fastigio-facial angle, produced below but deplanate in all of produced portion (from slightly above antennae to near median ocellus). Pronotum granulate; cephalic margin of disk truncate, showing only a trace of median angulate production; caudal portion of disk subulate, projecting to base of genicular areas of caudal femora, not narrowing evenly but as described above; surface of disk weakly tectiform, somewhat uneven, showing slight swellings between the shoulders and weak impressions at the post-humeral spots; median carina percurrent, in lateral aspect showing distinct convexity cephalad of the shoulders, thence weakly undulate caudad; cephalic carinae well developed, moderately convergent caudad; from the humeral angles two delicate but distinct carinae converge to meet before the caudal apex, the lateral areas between these and the pronotal margins more strongly deflexed. Lateral lobes of pronotum with humeral sinus rectangulate, inferior sinus forming a sharp angle of slightly less than ninety degrees, ventro-caudal portion deflexed, truncate with angles rounded. Tegmina elongate oval. Wings reduced, failing to reach the pronotal apex by fully the tegminal length. Margins of femora

[16] Twenty-five species of *Acrydium* are now represented in the collections at the Academy.

showing extremely weak undulation. Caudal metatarsus about one and four-fifths times as long as third tarsal joint, its second pulvillus longer than the first, its third elongate, shorter than the combined length of the other two.

Allotype.—♂; same data as type. [Hebard Collection.]

Agrees closely with female, but differs in the following features. Size smaller, pronotum even more abbreviate, failing to reach genicular areas of caudal femora by a short distance. Vertex with cephalic margin transverse.[17] Frontal costa similar in lateral aspect, except that below the fastigio-facial angle it is even more weakly concave. Disk of pronotum very similar except that the medio-longitudinal carina is slightly more undulate caudad.[18] Caudal metatarsus decidedly less than twice as long as last tarsal joint.[19]

General coloration of male blackish brown, with caudal femora mottled with bister; of female snuff brown marbled with bister, the humeral spots blackish brown, the medio-longitudinal carina flecked with that color. External face of caudal femora pinkish buff mottled with bister. Caudal tibiae blackish brown, annulate with buffy proximad and incompletely meso-distad.

Length of body, ♂, 8.4; ♀, 10.3: length of pronotum, ♂, 6.7; ♀, 8.1: greatest width of pronotum, ♂, 2.8; ♀, 3.1: length of caudal femur, ♂, 5.1; ♀, 6: length of ovipositor, 1.7 mm.

This interesting species is known only from the described pair.

Group *Batrachideae*

Batrachidea inermis new species (Plate XI, figure 3.)

This species is nearest *B. flavo-notata* Bolivar, in the abbreviate phase[20] agreeing closely in the pronotal contour. It differs in the slightly less robust form, more declivent and decidedly weaker median carina of the vertex where this begins practically at the inception of the frontal costa, the immaculate tegmina, the unarmed dorsal genicular angle of the median femora, and in the female subgenital plate, which is not transversely truncate (as in both *flavonotata* and *mucronata*), but shows weak concavity laterad and very weak convexity mesad of the caudal margin.

[17] This slight difference is probably individual rather than sexual.

[18] Doubtless a feature of slight individual variability.

[19] Probably also a feature of individual variability.

[20] In the caudate phase, as is true for *B. mucronata* (Serville) and probably *flavo-notata*, the median carina of the pronotum is decidedly weaker and the lateral portions of the pronotal disk in consequence appear scarcely at all concave.

Type.—♀; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 878.]

In addition to the features remarked above, the following are noteworthy. Size and form much as in the genotype, *mucronata*, eyes slightly more prominent. Vertex very slightly wider, its surface showing concavity toward the eyes, this strongest caudad; vertex not produced cephalad as far as the eyes, its cephalic margin convex and subcarinulate laterad, flattening mesad, from which point the weak median carina originates, to slant strongly ventrad, shortly forking to form the narrow frontal costa. In lateral aspect the frontal costa is seen to be produced between the antennae, slanting evenly from that rounded portion both dorsad and ventrad. Pronotum with cephalic margin produced in a sharp spike, which extends to a point above the inception of the median carina of the vertex, surface evenly granulate (type abbreviate,[21] paratype caudate[22]). Tegmina with apices rather sharply rounded. Caudal metatarsus and last joint approximately equal in length, third pulvillus of former slightly longer than first or second pulvilli, which are subequal in length.

General coloration blackish brown. Palpi light buffy. Tegmina immaculate blackish brown. Ovipositor, dorsal and ventral surfaces of abdomen buffy, the dorsal surface with brown flecks mesad. Thoracic sternites black. Cephalic and median tibiae each with two vague buffy annuli. Caudal tibiae blackish brown, with a trace of brown annulation proximad. Tarsi brown, the last joint very dark proximad and distad.

The measurements of the type are given first. Length of body, 13 and 13; length of pronotum, 12.7 and 13.1; humeral width of pronotum, 3 and 3; length of caudal femur, 8.2 and 7.8; length of ovipositor, 1.8 and 1.8 mm.

In addition to the type, a single paratypic female, bearing the same data, is before us. The discovery of this new species in the Colombian Chocó is of particular interest, as the genus has not been reported from Central America, nor is it represented in the large unstudied collections from that territory now before us.

[21] Pronotum extending to genicular areas of caudal femora. Wings decidedly reduced, incapable of flight.

[22] Pronotum extending slightly beyond genicular areas of caudal femora. Wings fully developed, extending considerably beyond pronotum.

Batrachidea flavo-notata Bolivar

1887. *B[atrachidea] flavo-notata* Bolivar, Ann. Soc. Ent. Belgique, XXXI, p. 300. [♂, ♀; New Granada [=Colombia].]

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 1 ♀ (abbreviate).

Though showing exceedingly close general resemblance to abbreviate females of *P. mucronata* (Serville)[23] the present example may be separated by the heavier medio-longitudinal carina of the pronotum, which divides the more distinctly, though very weakly, concave lateral portions of the disk, the weakly spined dorsal genicular angle of the median femora and the large buffy spot on the tegmina.

Length of body, 12.3; length of pronotum, 11.3; humeral width of pronotum, 3.2; length of caudal femur, 7.8; length of ovipositor, 1.9 mm.

Scaria brevis Hancock

1909. *S[caria] brevis* Hancock, Trans. Ent. Soc. London, 1909, p. 426. [♂; Cachabi, Ecuador.]

Andagoya, Antioquia (Chocó), IV, 22, 1918, (M. A. Carriker, Jr.), 2 ♂ (1 caudate), 1 juv. ♂.

In the present specimens the ventral half of the pronotal lateral lobes and genae and all of the face is cream color, in sharp contrast with the blackish brown dorsad. These all belong to a color phase in which the dorsum of the pronotum is uniform light drab.

In size and form the species approximates *S. hamata* (DeGeer).[24] The insect may be readily distinguished by the weakly protruding frontal costa, unarmed median femora, blackish and immaculate tegmina and caudal femora (the latter in decided contrast with the other limbs, which are cinnamon brown) and abdomen which becomes cream color distad.

The choice of name was unfortunate, as the species develops a fully caudate, as well as an abbreviate, condition.

Length of body, 8.2 to 9.3; length of pronotum, 8.5 to 11.2; humeral width of pronotum, 1.9 to 2; length of caudal femur, 6.3 to 6.7 mm.

[23] A large series of *mucronata*, from Peru and Bolivia, is before us.

[24] Comparison is made with a series from the Island of Trinidad and British and Dutch Guiana in the Philadelphia Collections.

Scaria fasciata Hancock

1901. *Scaria hamata* Morse (not *Acrydium hamatum* DeGeer, 1773), Biol. Cent.-Amer., Orth., II, p. 19. [♂; Los Sabalos River, north-west from Castillo, Nicaragua.]

1907. *S[caria] fasciata* Hancock, Trans. Ent. Soc. London, 1907, p. 244. [♂, ♀; Cachabi, Ecuador.]

Andagoya, Antioquia (Chocó), IV, 22, 1918, (M. A. Carriker, Jr.), 1 ♂, 1 ♀.

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 1 ♂.

Comparison of the type,[25] with the female determined as *hamatum* by Morse, enables us to correct the above Nicaraguan record. This handsome and slender little species is also represented by a large Panamanian series before us. It is apparently the only species of the genus which occurs in Central America.

The genotype, *S. hamata* (DeGeer) differs from *fasciata* in being more robust, with vertex broader, dorsal genicular spine of median femora developed into a stout spike, and dorsal genicular angle of caudal femora developed into a stronger triangular projection. The female subgenital plate is more nearly bilobate in *hamata*, with the minute meso-distal cleft broader and lateral portions of distal margin rounding evenly into it, not produced in a minute projection on each side of it, as is true for *fasciata*.

EUMASTACINAE

Group *Eumastices*

Though reviewed or revised by Burr in 1899, Saussure in 1903 and C. Bolivar in 1914, we find the genera of this group to be poorly defined and the assignment of a number of species unnatural. This is particularly true for *Scirtomastax*, the major reason for the subsequent assignment of species there being due to their apterous condition. This would be convenient, but violates the natural arrangement. From our present studies we are convinced that reduction or loss of the organs of flight has, by itself, no generic value in this group and that other, more subtle, differences must be used. We are, however,

[25] A female here selected, taken by Rosenberg at Cachabi, Ecuador, elevation 500 ft., December, 1896, Hebard Collection, type no. 879.

satisfied that not only are all of the previously erected genera valid, but that *Masyntes*, as at present defined, includes two generic units, while three additional generic units are represented in the Colombian material now under consideration. Except in the case of *Masyntes* and its allies, these genera all differ considerably in appearance, but on analysis can be separated only by unusually subtle features.

Eumastax cerciata new species (Plate XI, figures 4 and 5.)

This insect is very closely related to the Panamanian *E. surdus* Burr,[26] agreeing generally in color pattern and structure, except that the male genitalia are very distinct, the cerci being particularly striking, heavy and falcate.

In both *surdus* and *cerciata* the caudal femora are red from the apex of the enlarged portion to the darkened genicular lobes, this marking in consequence being distinctly more distal than in *E. carrikeri*, here described.

Type.—♂; Porto Bello, Panama. February 19, 1911. (A. Busck.) [United States National Museum.]

Size and form medium for this genus of small and slender species, larger than in *carrikeri*. Median carina of vertex subobsolete. Frontal costa below median ocellus with slender lateral carinae moderately decided and nearly parallel, terminating at a low triangular scutellum above the clypeus, lateral carinae of face equally prominent. Pronotal disk with a very weak medio-longitudinal carina, caudal margin weakly produced, broadly convex with angulation weakly indicated; lateral lobes with ventro-caudal angle slightly less than ninety degrees, its apex sharply rounded. Tegmina and wings fully developed, hyaline, extending well beyond apex of abdomen, nearly to genicular areas of caudal femora. Apex of abdomen decidedly clavate. Ninth tergite enlarged, with a heavy transverse sulcus proximad, beyond this forming two large and faintly convex areas above the cerci, separated by a medio-longitudinal line. Supra-anal plate very small, linguliform, declivent, with surface strongly concave, then very strongly declivent in the narrow, acute-angulate distal portion. Cerci large and heavy,

[26] Described by Burr from a female from "Chiriqui, Peru," clearly in error for Panama. Saussure has described a female as *E. dentatus*, from Palmares, Costa Rica. No differences of diagnostic value are given to separate it from *surdus*, and, from our present knowledge of Central American Orthoptera, we feel satisfied that *dentatus* will prove a synonym of that species. A large series of the genus from Costa Rica, now before us, represents only the single species, *surdus*.

extending slightly beyond apex of subgenital plate and very weakly curved inward; proximad of equal width to just before median point and weakly ascendant, there expanding slightly, thence as weakly declivent and narrowing gradually and weakly to the narrow, rounded apex. Penultimate sternite large, nearly quadrate and convex. Subgenital plate convex with a faint medio-longitudinal carina distad toward the apex at the free margin, lateral portions of free margin rather decidedly convex, so that the apex of the plate at their juncture mesad appears angulate-emarginate in caudal aspect. Caudal metatarsus with dorsal surface flattened between the delicate lateral carinae, which are microscopically subtuberculate at the bases of the hairs.

Allotype.— ♀ ; same data as type. [United States National Museum.]

Agrees with male closely, except as follows. Size larger, form slightly more robust. Caudal margin of pronotal disk slightly more broadly rounded. Tegmina and wings extending to apex of ovipositor (or slightly beyond in individuals with abdomen retracted), but failing to reach apices of caudal femora by a slightly (average) greater distance than in male. Ovipositor with dorso-external margins of dorsal valves with (six to seven) large teeth and a few minute proximal denticulations; ventro-external margins of ventral valves with more irregular teeth and mesad with a transverse flange across ventral surface (in place of the tooth of the ventro-internal margin found in *carrikeri*). Subgenital plate rounding distad with apex angulate, the free margin latero-distad armed dorsad with minute teeth.[27]

Coloration of male. Face colonial buff, tinged with greenish on two proximal antennal joints, mouthparts and genae and margins of occiput toward eyes; remaining antennal joints, median V-shaped portion of occiput, a lateral fleck on occiput and a post-ocular bar blackish brown. Pronotum, pleura and dorsum of abdomen proximad olive ocher, the abdomen suffused with brown distad, the cerci black. Pronotal lateral lobes with a small suffusion of brown dorso-caudad. Tegmina and wings transparent, hyaline, very faintly tinged with brown, veins dark brown. Cephalic and median limbs olive ocher, becoming greenish distad. Caudal femora olive ocher in enlarged portion, with carinae black, thence scarlet red to near genicular sections with proximal and distal portions of a darker shade, a very brief area of olive ocher before the blackish brown genicular areas. Caudal tibiae buffy suffused with brown except for a

[27] These consequently fitting tightly against the ovipositor, unless the subgenital plate is deflexed.

clear buffy brief area, forming a proximal annulus, and another similar but broader annulus a brief distance beyond.

General coloration of female similar but less contrasting, the face only slightly paler than the almost solidly brown occiput and genae. The abdomen is nearly uniform brownish.[28]

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of tegmen	Distal (greatest) tegminal width	Length of caudal femur
Porto Bello, Panama, *type*	15	2.1	12.3	1.6	12.2
Porto Bello, Panama, *paratypes*	15–15.2	2.1–2.3	12.8–12.5	1.8–1.9	12.2-12.3
♀					
Porto Bello, Panama, *allotype*	19	2.7	14.4	1.9	15.1
Porto Bello, Panama, *paratypes*	19–18.5	2.5–2.7	13.7–13.4	2.1–1.9	13.4-15
Boca Murindo, Chocó, Colombia	18	2.7	14.8	2.2	13.8
El Tambo, Chocó, Colombia	21.5	2.9	15.8	2.4	15.1

The Colombian specimens agree in all respects with those from Panama, except in the greater tegminal length and absence of a small brown suffusion on the dorso-caudal portion of the pronotal lateral lobes.[29] Males from the Colombian Chocó may show that a distinct but closely allied species is represented, but this we believe unlikely. The possibility is suggested mainly by the fact that females of the allied *surdus*, from Chiriqui, Panama, and numerous localities in Costa Rica, before us, can not be distinguished from females of the present species, except by the average shorter tegmina and wings and constant lack of marking dorso-caudad on the pronotal lateral lobes. Males of *surdus* have a much less complex genitalic development, with the cerci simple and straight, as in the majority of the species of *Eumastax*.

[28] The females before us have become discolored to different degrees. It is probable that the natural colors are more difficult to preserve in this sex than in males.

[29] One Panamanian female, however, also lacks such marking.

Specimens Examined: 21; 9 males, 11 females and 1 immature individual.

Porto Bello, Panama, II, 19 to III, 10, 1911 and IV, 15 and 18, 1912, (A. Busck), 9 ♂, 9 ♀. *type, allotype* and *paratypes,* [U. S. N. M.].

Gatun, Canal Zone, Panama, VIII, 6 to 22, 1916, (D. E. Harrower), 1 large juv. ♀.

Boca Murindó, Intendencia del Chocó, Colombia, II, 9, 1918, (M. A. Carriker, Jr.), 1 ♀.

El Tambo, Intendencia del Chocó, Colombia, IV, 5, 1918, (M. A. Carriker, Jr.), 1 ♀.

Eumastax carrikeri [30] new species (Plate XI, figures 6, 7 and 8.)

This handsome little grasshopper, with dark occiput and genae, buffy face, largely yellow pronotum, pleura, abdomen and femora, with apex of male abdomen dark and medio-distal portion of caudal femora red, is apparently nearest the female, described by Burr as *E. collaris* (Gerstaecker),[31] from Paramba, Ecuador (not Bolivia).

Type.—♂; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 870.]

Size small, form slender. Head as here described for *E. cerciata.* Pronotal disk with a very weak medio-longitudinal carina, caudal margin produced, forming an angle of distinctly more than ninety degrees, its apex broadly rounded; lateral lobes with ventro-caudal angle slightly less than ninety degrees, its apex sharply rounded. Tegmina and wings fully developed, hyaline, extending slightly beyond apex of abdomen, the latter only slightly thickened. Supra-anal plate small, with distal portion triangular, a median impressed area proximad with its caudal margin convex. Cercus small, simple, straight, cylindrical, tapering feebly, then with apex rounded and very slightly thickened, lying opposite apex of supra-anal plate. Subgenital plate small, convex, showing merely a trace of medio-longitudinal carination, its free dorsal margin very broadly convex on each side. Caudal metatarsus as in *cerciata.*

Allotype.—♀; same data as type. [Hebard Collection.]

Agrees closely with male, except as follows. Size larger, form slightly more robust. Caudal margin of pronotal disk

[30] Named in honor of Mr. and Mrs. M. A. Carriker, Jr., whose many expeditions into the more inaccessible regions have added so much to the knowledge of the Colombian fauna.

[31] Anal. Soc. Españ. Hist. Nat., XXVIII, p. 263, (1899). It seems unlikely that specimen represents the same species as the *Mastax collaris,* described by Gerstaecker from Saracayon, (probably Sara-yacu), Peru.

slightly more broadly rounded, lateral lobes with ventro-caudal angle slightly less than ninety degrees. Tegmina and wings extending to near median portion of ovipositor. Ovipositor valves as in *cerciata*, except that in place of a flange mesad on the ventral surface of the ventral valves, there is a single small meso-distal tooth on the internal margin. Subgenital plate with a delicate medio-longitudinal carina, proximal portion convex, distad slenderly produced, the lateral margins strongly convergent, then weakly diverging and again as weakly converging to the sharply rounded apex, forming a slender lanceolate apical portion.

Coloration. Male. Occiput, genae and all but two proximal antennal joints blackish brown, with traces of several paler, olivaceous, postocular lines indicated. Two proximal antennal joints and face to clypeal suture and lateral carinae cream color, clypeus and labrum also pale but tinged with greenish. Pronotum apricot yellow, the caudal portion of the disk and small dorso-caudal portion of lateral lobes suffused with brown. Ventral surface cream color. Pleura and remaining portions of abdomen to near apex apricot yellow, the abdominal apex suffused with blackish. Tegmina and wings transparent, hyaline, with blackish brown veins; the tegmina with a faint brown tinge, the wings with a faint milky tinge. Cephalic and median limbs and enlarged proximal portion of caudal femora apricot yellow; the latter with black carinae, thence to just before genicular areas peach red, deepened proximo-mesad and distad, the shaft before the genicular area buffy, the latter blackish laterad. Caudal tibiae buffy with black carinae and spines, except for a wholly buffy brief area, forming a proximal annulus and another similar but broader annulus, a brief distance beyond.

Female similarly colored, except as follows. Occiput and postocular portions of genae showing more numerous flecks of olivaceous. Tegmina with anal vein and proximal veinlets of anal field olivaceous. Abdomen showing obscure and poorly defined longitudinal bands of blackish brown, but less strongly suffused with blackish distad.

The measurements of the type and allotype are given first, followed by the extremes in the series of six male and four female paratypes, which bear the same data. Length of body, ♂, 11.8, 12 to 12.2; ♀, 16.3 (retracted), 15.8 (retracted) to 17.2: length of pronotum, ♂, 1.9, 1.9 to 2; ♀, 2, 2.2 to 2.3: length of tegmen, ♂, 9.3 9.3 to 9.8; ♀, 10.3, 10.2 to 10.2: distal (greatest) width of tegmen, ♂, 1.3, 1.3 to 1.3 ; ♀, 1.5 1.4 to 1.7: length of caudal femur, ♂, 9.3, 9.4 to 10; ♀, 12.2, 11.9 to 12 mm.

Eumastax apolinari[32] new species (Plate XI, figure 9.)

Clearly nearest the Colombian *E. poultoni* Burr, the present male may be distinguished by its smaller size, shorter organs of flight and conspicuous differences in the striking color pattern.

These two species have no red on the limbs, but have the abdomen strikingly marked with that color.

Type.—♂; Susumuco, Cundinamarca, Colombia. Elevation, 2600 feet. April, 1920. (From A. Maria.) [Hebard Collection, Type no. 871.]

Size small, form slender, though not as slender as in *E. carrikeri*, here described. Median carina of vertex obsolete. Frontal costa as in that species, except that the lateral carinae are heavier. Pronotal disk with medio-longitudinal carina only in caudal portion, there subobsolete, caudal margin very feebly produced, very broadly convex; lateral lobes with ventro-caudal angle rectangulate. Tegmina and wings extending only to base of supra-anal plate, hyaline. Apex of abdomen clavate. Supra-anal plate with distal portion acute-angulate produced.[33] Cercus small, simple, straight, cylindrical, tapering very gently to the sharply rounded apex. Subgenital plate large and broad.[34] Caudal metatarsus as described for *carrikeri*.

Coloration. Male Occiput and genae and all but two proximal antennal joints blackish brown, the latter cream color. Face to and including lateral carinae down to clypeal suture apricot yellow, mouthparts brownish, the clypeal suture darker laterad. Pronotum, pleura and cephalic and median limbs apricot yellow, the tibial carinae distad and tarsi embrowned. Tegmina and wings transparent, hyaline, with blackish brown veins, the former strongly tinged with brown. Abdomen with first, second and third tergites apricot yellow, the second marked with blackish brown dorsad, the third with this marking more extensive; fourth and fifth tergites almost entirely blackish brown, showing two narrow longitudinal bands of yellowish on each side ventrad, the sixth similar but tinged with olivaceous

[32] It gives us great pleasure to name this distinctive species in honor of Hermano Apolinar Maria, whose constant additions of Colombian material for study, during the past years, has resulted in our having a far larger representation from central Colombia and the tropical eastern slopes of the Andes than we had imagined it possible to secure.

[33] The genitalia normally concealed by the pallium are extruded in this specimen. Two fang-like, recurved spines project from the soft integument and extend dorso-cephalad on each side of the supra-anal plate.

[34] Crushed in this specimen in such a manner that its true form can not be determined.

dorsad and with suffusions of scarlet red meso-distad and ventro-laterad; seventh and eighth tergites solidly brilliant scarlet red, succeeding portions of tergites which project laterad, cerci and supra-anal plate blackish brown. Ventral surface olivaceous, of the abdomen weakly suffused with brownish. Caudal femora olive-yellow with carinae and genicular areas blackish. Caudal tibiae olivaceous with carinae and spines blackish.

Length of body, 12.5; length of pronotum, 2.2; length of tegmen, 6.3; distal (greatest) width of tegmen, 1.2; length of caudal femur, 10 mm.

The type of this unusually handsome grasshopper is unique.

SANTANDERIA new genus

This genus is erected to include a single species, *S. lita*, here described, which would hitherto have been placed in *Scirtomastax*, due to the absence of organs of flight. The insect agrees best with *Eumastax* and *Paramastax*,[35] differing from the species of both in the abrupt angulation of the lateral carinae of the vertex, which do not round evenly into the lateral carinae of the frontal costa, as they do in those species. In lateral aspect the bare visibility of the rounded apex of the fastigio-facial angle above the contour of the eye shows agreement with *Paramastax*, but the more slender form, rounded ventro-caudal angles of the pronotal lateral lobes and simple male genitalia indicate closer affinity to *Eumastax*.

Vertex not produced, the lateral carinae of its surface, however, rounding suddenly into the lateral carinae of the frontal costa. The fastigio-facial angle thus formed rectangulate in the male, slightly more obtuse in female; its rounded apex in lateral aspect just visible dorso-cephalad above the eye. Frontal costa disappearing on face immediately above clypeal suture. Pronotum with a weak but distinct medio-longitudinal carina, which is strongly developed on the mesonotum, metanotum and abdominal tergites; caudal margin of pronotal disk with a small median angulate-emargination;[36] lateral lobes with ventro-caudal angle rectangulate, rounded in female, more strongly so in male. Tegmina and wings absent.[37] Male genitalia simple. Female subgenital plate specialized. Ovipositor with ventro-

[35] We discuss this genus on page 186, assigning additional species to it and indicating the possibility of the synonymy of *Scirtomastax*.

[36] In the single known species, which is apterous.

[37] As we note under *Paramastax*, this can not be taken as having definite generic value. In many of the genera of the Eumastacites we are confident species will be found ranging from apterous to fully macropterous.

internal margin armed with a single meso-distal tooth, the ventral surface unmodified. Antennae, limbs and metatarsi as in *Eumastax* and the other related genera.

Santanderia lita new species (Plate XI, figures 10, 11, 12 and 13.)

The short red bar on the caudal femora, situated just beyond the apex of the enlarged portion, is a striking feature in the present insect. The striking yellow band in each side, running from face to ninth tergite in males, is less contrasting in females, but in that sex is often largely red, except on the head.

Type.—♂; La Pica, Santander, Colombia. Elevation, 9000 feet. February 10 to 15, 1917. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 875.]

In addition to the generic features noted above, we give the following. Size small, form slender. Medio-longitudinal carina of vertex subobsolete. Frontal costa deep, with strong lateral carinae. Eyes moderately prominent. Lateral carinae of pronotum broad, but very low and irregular. Distal portion of abdomen slightly thickened. Tergite preceding supra-anal plate depressed mesad and there medio-longitudinally sulcate. Supra-anal plate triangularly shield-shaped. Cerci simple, cylindrical, showing a very faint inward curvature and tapering very weakly to their rounded apices, which extend well beyond apex of supra-anal plate. Subgenital plate simple, convex, with free dorsal margin horizontal.

Allotype.—♀; same data as type. [Hebard Collection.]

Differing from male as follows. Size considerably larger, form decidedly more robust. Caudal margin of lateral lobes and pronotal disk broadly convex, meeting mesad to form a stronger angulate emargination. Subgenital plate with lateral free margins curving into the broadly truncate distal margin, which is armed with numerous, stout, irregular denticulations, directed caudad.

Coloration. Male. Occiput and dorsal portion of genae, disk and dorsal portion of lateral lobes of pronotum, all of mesonotum and metanotum and corresponding portion of abdomen blackish brown. Antennae buffy, tinged with green proximad, suffused with brown distad. Mouthparts and supra-clypeal portion of face buffy, suffused with brown. Remaining portions of face, genae and ventral portion of lateral lobes of pronotum wax yellow, this continued as a band across pleura and along sides of abdomen to ninth tergite, there broadening and paling to straw yellow; this band sharply defined. Ventral surface of thorax honey yellow, of abdomen warm sepia. Distal portion of abdomen blackish brown, with all but proximal

portion of subgenital plate grayish. Cephalic and median limbs olive ocher, the tibiae and tarsi suffused with brown. Caudal tibiae olive ocher, a band of garnet red (individually varying to garnet brown (a deep purplish red)) in proximal third of distal half (at end of enlarged proximal portion), genicular areas suffused with blackish brown, the carinae outlined in that color in enlarged proximal portion. Caudal tibiae buffy, evenly suffused with brown.

Female very similarly colored, except that the lateral bands are often nopal red on the lateral lobes of pronotum, pleura and abdomen.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of caudal femur
La Pica, *type*	10.5	1.9	8.7
Peña Blanca, *paratypes*. (8)	10.4–11.4	1.9–2	8.7–8.8
♀			
La Pica, *allotype*	16.5	2.3	9.9
Peña Blanca, *paratypes*. (7)	14.7[38]–16.1	2.2–2.4	10–10.3
Palmar, *paratypes*. (2)	14[38]–17	2.3–2.5	10.6–11

Specimens Examined: 29; 8 males, 10 females and 10 immature individuals.

La Pica, Santander, II, 10 to 15, 1917, (M. A. Carriker, Jr.), 1 ♂, 1 ♀, *type* and *allotype*.

Peña Blanca, near Sogomoso River, Boyacá, about 8000 feet elevation, in eastern Andes (nearest village, Malagavita), II, 28, 1917, (M. A. Carriker, Jr.), 8 ♂, 7 ♀, *paratypes*, 5 juv. ♂, 5 juv. ♀.

Palmar, Rio Casenare, Boyacá, IV, 1917, (M. A. Carriker, Jr.), 2 ♀, *paratypes*.

PARAMASTAX Burr

Genotype.—*Paramastax nigra* (Scudder), by original designation.

This genus was limited to the genotype by C. Bolivar in 1914,[39] but we now believe *Eumastax rosenbergi* Burr and *Mastax mutilata* Serville, which have subsequently been referred to *Scirtomastax*, to be members of *Paramastax*, as well as a new species here described.

It would appear to be very possible that *Scirtomastax cordillerae* Saussure and *Scirtomastax chopardi* C. Bolivar are also referable to *Paramastax*. If this should be true in the first case, *Scirtomastax* would fall as a synonym of the present genus, *cordillerae* being its genotype.

[38] Abdomen shrivelled.

[39] Trab. Mus. Nac. Cienc. Nat., Ser. Zool., no. 16, p. 24.

We believe that the genus *Paramastax* may be distinguished by the following features. Fastigium of vertex not produced, rounding evenly into the frontal costa, but with lateral carinae moderately thickened between the eyes and slightly elevated, so that in lateral aspect their upper margins are just visible dorso-cephalad above the eyes. Pronotum, when tegmina and wings are fully developed, with caudal margin angulate produced with apex convex; when tegmina and wings are vestigial, with caudal margin showing a small angulate emargination mesad. Pronotum with a very faint medio-longitudinal carina; ventro-caudal angle of lateral lobes sharp, acute-angulate, weakly to strongly produced ventro-caudad. Frontal costa disappearing on face mesad or just below that point. Tegmina and wings fully developed or vestigial; in the former condition both are opaque, in the latter the tegminal pads are opaque. Male cerci stout in proximal portion, slender distad with this portion strongly incurved. In other respects the genus agrees closely with *Eumastax* Burr.

Paramastax rosenbergi (Burr) (Plate XI, figures 14 and 15.)

1899. *Eumastax rosenbergi* Burr, Anal. Soc. Españ. Hist. Nat., XXVIII, p. 266. [♂; Pielrindé, Colombia.]

La Cumbre, Cordillera Occidental, El Valle, V, 18 and 19, 1914, (H. S. Parish), 4 ♂, 4 ♀, 1 juv. ♂, [A. N. S. P.].

Jiminez, Cordillera Occidental, El Valle, (M. G. Palmer), 1 ♂, [A. N. S. P.].

The lateral lobes of the pronotum are deep chrome in the series from La Cumbre, mahogany red in the Jiminez individual.

Paramastax poecilosoma new species (Plate X, figure 3; plate XI, figures 16 and 17.)

Compared with the description of *P. mutilata* (Serville),[40] the present male is found to differ in the face being dark in ventral half, the tegmina margined with yellow on sutural as well as costal margins, the distal abdominal marking scarlet instead of yellow. The description of *mutilata* gives few characters of structural value, and we believe that examination of the type will reveal important features of structural difference, particularly in the sexual specialization.

[40] The description of that species shows such close agreement with *poecilosoma* that we feel confident the generic association here indicated, will be proven correct by examination of the type of *mutilata*.

This handsome insect agrees with *P. rosenbergi* (Burr) in general form and coloration of the limbs. It differs in the very distinctive body coloration, tegminal and wing pads, which show less reduction, and in the male sex in the remarkable median production of the eighth[41] tergite.

Type.—♂; La Sierra,[42] Cauca, Colombia. Elevation, 6800 feet. March 1, 1912. (Allen and Lloyd.) [Hebard Collection, Type no. 872.]

Size medium and form slender as in *rosenbergi*. Lateral carinae of vertex becoming moderately thickened and very feebly raised between eyes, thence curving ventrad and strongly declivent; no median carina indicated. Frontal costa below median ocellus indicated by a channel, bounded by moderately thickened lateral carinae, to very slightly below median portion of face, where it disappears; lateral carinae of face slender and weak, but bounded externally by a moderately concave area. Pronotal disk with medio-longitudinal carina weakly indicated only toward caudal margin, that margin with a small obtuse-angulate emargination mesad; lateral lobes with ventro-caudal angle sharply angulate at distinctly less than ninety degrees. Tegmina and wings vestigial; the former slightly longer than pronotum, subattingent, lanceolate but with apices rounded. Wings minute pads hidden beneath tegmina and failing to reach their apices by a third the tegminal length. Abdomen strongly clavate distad, seventh tergite enlarged, eighth more strongly so with median portion produced, directed dorso-caudad in a large projecting plate, the margin of which is evenly convex. Below this the succeeding tergite has a large flattened median area, produced mesad in the small, narrowly triangular supra-anal plate. Cercus with proximal portion represented by a stout, straight shaft, distal portion represented by a slender shaft, curved so strongly inward that its apex points meso-cephalad. Penultimate sternite large and convex, separated from the subgenital plate by a broadly transverse subchitinous area. Subgenital plate with free lateral margins convex, so that their juncture mesad, in caudal aspect, appears angulate-emarginate. Caudal metatarsi missing.[43]

Proximal two antennal joints, face below these in dorsal portion and dorsal half of genae buffy; occiput, remaining portions of antennae and lower half of face and genae blackish

[41] Counting the median segment as the first tergite.

[42] A village two days south of Popayan, at the headwaters of the Rio Patia, where collecting was done in a small grove of open forest.

[43] Probably as in *rosenbergi*, with dorsal surface flattened between the very weak lateral carinae, which are microscopically sub-tuberculate at the bases of the hairs.

brown, mouthparts buffy with a greenish tinge. Disk of pronotum yellowish heavily suffused with brown, a broad longitudinal band of dark brown on each side, which includes the dorsal margin of the lateral lobes, remaining portions of lateral lobes light cadmium (a bright yellow). Tegmina black with a very narrow sutural and broader costal marginal band of light cadmium. Wings pads whitish. Pleura buffy ventrad, marked with blackish brown dorsad. Proximal abdominal tergites blackish brown with large vague spots of yellowish, so arranged that the abdomen in this portion shows four very weakly defined and irregular longitudinal dark bands. Sixth tergite tinged with flame scarlet disto-laterad, seventh tergite flame scarlet in all but narrow meso-proximal area, eighth tergite uniform flame scarlet, remaining distal portion of abdomen blackish. Limbs buffy yellow, with all carinae blackish.

Length of body (abdomen extended), 13.7; length of pronotum, 2; length of tegmen, 2.7; greatest (median) width of tegmen, .9; length of caudal femur, 11.3 mm.

The type of this handsome and distinctive species is unique.

CAENOMASTAX new genus

This remarkable genus includes two new species here described, of which we select *C. insignis* as genotype. Both species are strongly brachypterous and agree best with the brachypterous forms of *Paramastax* here discussed. The heavy and differently colored veins of the opaque tegmina, however, rather suggest the genus *Pseudomastax* C. Bolivar.

The very strong production caudad of the pronotal disk is a striking feature in *insignis*, not shared by *C. atopa*, here described, or any other known species of the Eumastacites. The outline of the female tegmina is equally unusual in *insignis*, but can not be used as a generic feature, as it is likewise not shared by *atopa*.

These two species are, in so many other respects, so evidently closely related, that we do not feel justified in considering them members of two distinct monotypic genera. Both differ from all other forms of the group in the remarkable specialization of the proximal abdominal tergites in the female sex.

Fastigium of vertex as in *Paramastax*, described on page 187. Frontal costa disappearing on face distinctly or just above clypeal suture. Pronotum with a very faint medio-longitudinal carina; caudal margin of pronotal disk very feebly

convex or sharply acute-angulate produced;[44] ventro-caudal angle of lateral lobes sharp but forming an angle slightly to considerably more than ninety degrees. Tegmina and wings vestigial. Tegmina covered with a network of relatively heavy and differently colored veinlets and variously specialized in the female sex. Male genitalia comparatively simple, cerci simple or elongate and sinuate. Female with latero-caudal angles of four proximal tergites produced in slender projections, the apices of which are sharply rounded. Ovipositor valves distinctly smaller in proportion to body bulk than in *Eumastax*, similarly armed except that the ventral valves have the internal margin supplied with a few minute teeth, the ventral surface of these being unmodified meso-distad. Antennae, limbs and metatarsi as in *Eumastax*.

Caenomastax atopa new species (Plate XII, figures 1, 2, 3 and 4.)

This handsome species differs widely from *C. insignis*, here described, in coloration, in the pronotum which shows very weak production of the disk caudad, the larger male tegmina and very differently specialized female tegmina, which are cucullate but have an even contour. The male cerci are specialized in *atopa*, simple in *insignis*.

Type.—♂; Muzo, Boyacá, Colombia. Elevation, 2700 feet. September, 1919. (From A. Maria.) [Hebard Collection, Type no. 873.]

In addition to the generic characters noted above, the following specific features are given for this sex. Size somewhat larger, form similar to that of the male of *insignis*. Head very similar to that species except that the lateral carinae of the frontal costa are distinct to near the clypeal suture. Pronotum ample, disk with a very feeble medio-longitudinal carina, caudal margin very broadly convex, almost transverse but showing a trace of angulation; lateral lobes with ventro-caudal angle very slightly greater than ninety degrees. Tegmina rudimentary, represented by elongate oval pads, which overlap and reach the base of the third abdominal tergite; humeral vein alone distinct, the surface elsewhere covered by a network of coarse veinlets. Apex of abdomen weakly clavate. Tergite preceding supra-anal plate flattened mesad, with a medio-longitudinal, linear sulcus; supra-anal plate small, triangular. Cerci elongate and slender, slightly tapering and very slightly diverging proximad, then cylindrical and very slightly convergent to distal portion, which curves rather strongly downward and outward to the acute apex. Subgenital plate simple, apparently much as in *insignis*.

[44] In the known species, both of which are strongly brachypterous.

Allotype.—♀; same data as type. [Hebard Collection.]

Differs from male as follows. Size larger, form more robust, though not as much so as in this sex of *insignis*. Eyes less prominent. Pronotum with caudal margin of disk even more broadly convex, almost transverse; lateral lobes with ventro-caudal angle slightly less acute and forming an angle distinctly greater than ninety degrees. Tegmina rudimentary but showing decidedly less reduction than in male, represented by lanceolate pads, the dorsal surfaces of which in large part overlap and are decidedly convex, the apices very sharply rounded; in length the tegmina nearly equal the combined length of head and pronotum. Proximal four abdominal tergites specialized as described in generic diagnosis, the projections of the ventro-caudal angles larger than in *insignis*. Ovipositor valves slightly more elongate than in that species. Subgenital plate with lateral portions of distal margin smooth and strongly convergent to the median portion, which is triangularly produced, with apex very sharply acute.

Coloration. Male. Occiput and genae olivaceous black, the former showing slightly paler streaks. Proximal two antennal joints, face (not including lateral carinae) and clypeus buffy, the two antennal joints marked with brown, the remaining portions of the antennae blackish. Remaining portions of mouthparts suffused with brown and showing a greenish tinge. Pronotum dull scarlet, fading to aniline yellow on metanotum and ventrad and caudad on lateral lobes. Tegmina with veins and veinlets aniline yellow, intervals between these (larger in discoidal field) medal bronze. Abdomen very dark maroon. Cephalic and median limbs aniline yellow, suffused with brown except proximad on femora. Caudal femora light cadmium, the carinae and genicular areas black. Caudal tibiae yellowish suffused with brown, this heavy on spines and in brief proximal area.

Female very similarly colored. Scarlet on pronotum less extensive, leaving caudal portion of mesozona, all of metazona and dorso-caudal portion of lateral lobes medal bronze. The entire discoidal fields of the tegmina are of this color, the veinlets in the allotype being there no paler than the intervals between.

Length of body, ♂, 13.4; ♀, 14.2: length of pronotum, ♀, 2.7; ♀, 2.9: length of tegmen, ♂, 3.1; ♀, 4.7: greatest width of tegmen, ♂, 1.3; ♀, 1.8: length of caudal femur, ♂, 11.5; ♀, 12 mm.

This remarkable species is known only from the described pair.

Caenomastax insignis new species (Plate XII, figures 5, 6, 7, 8 and 9.)

This insect is compared with *C. atopa*, here described, under that species. The strong production caudad of the pronotal disk and irregular distal contour of the female tegmina constitute features previously unknown for any species of the Group Eumastacites.

In the male sex the production caudad of the pronotal disk is weaker but distinctive, the tegmina are simple in outline.

Type.—♂; Muzo, Boyacá, Colombia. Elevation, 2700 feet. September, 1919. (From A. Maria.) [Hebard Collection, Type no. 873.]

Size and form about average as found in the genus *Eumastax*, comparatively small for the group. Vertex with a faint medio-longitudinal carina. Frontal costa subobsolete ventrad of just below median point on face. Eyes projecting, the lateral carinae of the vertex visible from the side only at their heaviest (dorso-cephalic) point. Pronotum ample, disk with a very feeble medio-longitudinal carina, caudal margin decidedly acute-angulate produced with lateral margins of this production broadly concave; lateral lobes with ventro-caudal angle considerably more than ninety degrees, forming almost as obtuse an angle as the ventro-cephalic angle. Tegmina rudimentary, represented by small, broadly oval pads which project only slightly beyond the caudal margin of the metanotum and are separated by an interval nearly equal to the width of one of them; surface covered by a network of coarse veinlets. Apex of abdomen weakly clavate, genitalia simple. Supra-anal plate small, triangular. Cerci simple, straight, cylindrical, with rounded apices slightly beyond apex of supra-anal plate. Subgenital plate convex to the apex formed by the nearly straight, very weakly convex free margins.

Allotype.—♀; same data as type. [Hebard Collection.]

This, the more distinctively specialized sex of the present species, may be distinguished as follows. Size larger, form considerably more robust. Eyes less prominent. Pronotum with metazonal portion produced, the discal portion strongly so, forming an acute-angulate projection with lateral margins feebly concave, surface in this portion pitted with medio-longitudinal carina stronger than elsewhere; lateral lobes with ventro-caudal angle sharper but forming a more obtuse angulation than ventro-cephalic angle. Tegmina rudimentary, but showing decidedly less reduction than in male, represented by broad pads which touch distad, thus covering proximal abdominal tergite. These pads are remarkably specialized, the mediastine field not narrowing but suddenly cut off distad, with angle

at costal margin broadly rounded; the discoidal field widening gradually an equal distance distad, there produced just within the discoidal vein in an acute-angulate projection, the outer margin of which projection is straight, the broader inner margin broadly concave. Proximal four abdominal tergites specialized as described in generic diagnosis, not as decided as in *atopa*. Subgenital plate emarginate distad with a small triangular median projection, the distal margin thus forming a broad W, the rounded lateral apices of the plate showing a few irregular serrulations. Ovipositor valves slightly less elongate than in *atopa*.

Coloration. Male. Occiput and genae dark brownish olive, with a blackish post-ocular bar and streaks of the same on occiput; proximal two antennal joints, face and clypeus yellow ocher, mouthparts whitish washed with brown, remaining portions of antennae dark brown. Pronotum yellowish oil green, becoming olive ocher on lateral lobes. Cephalic and median limbs olive ocher in proximal portions of femora, elsewhere darker, yellowish oil green. Tegmina with heavy network of veinlets yellowish oil green, the minute intervals between these olivaceous black. Dorsal surface of abdomen dark olive, paling to light yellowish olive laterad, apex blackish, the subgenital plate gray overlaid with blackish. Caudal femora yellow ocher proximad, slightly more than the distal half of the enlarged portion nopal red, remaining portions olive ocher to the black genicular area, all of the carinae outlined in black. Caudal tibiae uniform olivaceous overlaid with blackish brown.

Female similarly colored except as follows. Occiput and genae often more solidly dark. Pronotum with prozonal and mesozonal portion of disk olivaceous black, this continued laterad in metazonal portion; lateral lobes with narrow dorsal portion as dark, remaining portions lemon yellow, the line between these portions irregular and vague. As a result the females are more brilliantly and contrastingly colored than the males of this species.

The measurements of the type and allotype are given first. Length of body, ♂, 12, 11.9 to 13.2; ♀, 12 (abdomen shrivelled), 14.2 to 14.4: length of pronotum, ♂, 3.1, 2.9 to 3.1; ♀, 4.6, 4.4 to 4.9: length of tegmen, ♂, 1.4, 1.1 to 1.3; ♀, 3.4, 3.2 to 3.7: greatest width of tegmen, ♂, .9, .8 to .9; ♀, 2.3, 2.3 to 2.4: length of caudal femur, ♂, 10.8, 10 to 11; ♀, 11.5, 11.3 to 12 mm.

A series of five male and six female paratypes, bearing the same data as the type, is at hand.

PROSCOPINAE

Prosarthria teretrirostris Brunner

1890. *Prosarthria teretrirostris* Brunner, Verh. k.-k. zool.-bot. Gesellsch. Wien, XL, p. 93, pl. III, figs. 1, a to e. [♂, ♀; Venezuela; Bogotá[45] and Santa Marta, [Colombia]; Cumbasi, [Peru].]

We here select, as type locality for the species, Santa Marta, Colombia.

Santa Marta, Magdalena, XII, 26, 1910 and X, 1917, (M. A. Carriker, Jr.), 4 ♂, 2 ♀.

Mamatoco, Magdalena, XII, 1911, (M. A. Carriker, Jr.), 1 ♀.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, probably at lowest portion, not over 2800 ft. elevation, VII, 1913, (M. A. Carriker, Jr.), 1 ♂, 3 ♀, 3 large juv. ♀.

Barranquilla, Atlantico, 1914, (from A. Maria), 5 ♂, 2 medium juv. ♀.

The series from the vicinity of Santa Marta has the ventral surface of the fastigium ox-blood red in all adults. In the Barranquilla adults, however, two have this area of the same color as the underparts elsewhere, three showing there a tinge of pink.

Considerable size variation is shown by the ten males. Length of body, ♂, 59.4 to 72.6; ♀, 112.7 to 117 mm.

Prosarthia caucensis new species (Plate XII, figures 10 and 11.)

Closely related to *P. teretrirostris* Brunner, the present insect may be distinguished by proportionately shorter and more robust pronotum, proportionately longer head with fastigium decidedly longer than the eye in both sexes, less protuberant eyes and more elongate male subgenital plate.

Though the fastigium shows nearly the same proportionate production in both sexes of *caucensis*, it is decidedly more produced proportionately in the female than in the male of *teretrirostris*. In consequence the fastigial difference between these species is not as striking in females as in males.

Type.—♂; Rio Cauca, Colombia. July. [Hebard Collection, Type no. 880.]

[45] There is little doubt that the species does not occur at or near Bogotá, Brunner's record being one of those where "Bogotá" merely indicates Colombia, as discussed in the introduction to the present paper.

Size medium for this group of large and very slender grasshoppers. Head slenderly cylindrical and narrowing gradually and evenly to eyes, not showing the brief but distinct widening at the eye characteristic of *teretrirostris*. Eye prominent but depressed, more so than in that species; its width slightly over twice length (about one and two-thirds times in *teretrirostris*). First antennal joint half as long as fastigium, about three-fifths as long as eye. Fastigium elongate and slender, horizontal, tapering very gently to the narrowly truncate apex, dorsal surface convex, showing faint impression toward the weak and rounded lateral carinae distad, in which portion alone these carinae are apparent, median carina obsolete (in *teretrirostris* faintly indicated only between eyes); more distinct carinae meso-laterad running from the eye to near apex of fastigium; ventral surface deplanate, becoming faintly convex distad, bounded by lateral carinae (not as strongly deplanate, with lateral carinae not as heavy as in *teretrirostris*). Pronotum and prosternum cylindrical, separated by a subobsolete line, surface thickly supplied with minute low tubercles as in *teretrirostris*, this portion being, however, proportionately shorter and decidedly heavier than in that species. Apterous. Mesonotum, metanotum and abdomen microscopically impresso-punctulate, the latter moderately clavate. Penultimate sternite decidedly more triangularly produced caudad beyond subgenital plate than in *teretrirostris*. Caudal femora as in that species, smooth, with a few microscopic tubercles arranged in lines in the scarcely enlarged proximal portion.

Allotype.— ♀ ; same data as male. [Hebard Collection.]

Differs from male much as does this sex of *teretrirostris*. Size much larger, form more robust. Caudal femora with microscopic tubercles proximad scarcely heavier than in male, weaker than in this sex of *teretrirostris*. Caudal tibiae distinctly more bowed than in male. Subgenital plate with caudal margin convex and showing a trace of median angulate production, not very weakly convex and subtruncate as in *teretrirostris*.

General coloration snuff brown, the limbs (and abdomen of female) tinged with olive. In the female faint longitudinal stripes of these colors are indicated on the dorsal surface of the abdomen. The ventral surface of the fastigium is not differently colored, as in the majority of adults of *teretrirostris* known to us.

Length of body, ♂, 80; ♀, 110: dorsal length of head, ♂, 13.7; ♀, 17: length of fastigium, ♂, 3.7; ♀, 4.8: length of pronotum, ♂, 18.8; ♀, 22.7: least width of pronotum, ♂, 1.8; ♀, 3: length of cephalic femur, ♂, 14.2; ♀, 16.7: length of caudal femur, ♂, 29; ♀, 35.3: greatest width of caudal femur, ♂, 1.3; ♀, 1.9: length of ovipositor, 5.7 mm.

The species is known from the described pair.

Proscopia aberrans new species (Plate XII, figures 12 and 13.)

This species agrees with *Apioscelis*, as defined by Brunner, in having the fastigium deflexed. This feature, however, is found to be shown to some degree in the males of other species of *Proscopia* and, in our opinion, can not be used as a differential generic character. The insertion of the cephalic limbs mesad or meso-cephalad in the prothorax and the elongate, very gently tapering and proportionately much less strongly swollen proximal portions of the caudal femora we believe to constitute the most important features in separating species of *Proscopia* from those of *Apioscelis*.

This species is apparently nearest the Peruvian *P. sagax* (Scudder).[46] The present male differs from the male type of that species in the shorter and more strongly deflexed vertex, more strongly tuberculate and slightly more slender pronotum, cephalic femora which are inserted mesad in the prothorax (not markedly cephalad of that point) and caudal femora which are very slightly heavier proximad, with surface of that portion tuberculate and armed with rows of small denticulations.

Type.—♂; Villavicencio, Intendencia del Meta, Colombia. Elevation, 1400 feet. 1919. (From A. Maria.) [Hebard Collection, Type no. 881.]

Size medium and form slender for the genus, which includes large and very slender species. Fastigium slightly over half as long as eye, dorsal surface strongly declivent from between eyes to the sharply rounded apex, slightly impressed between the weak lateral carinae which run to caudal margin of eyes, a fine medio-longitudinal carina indicated only between eyes; ventral surface horizontal, defined from the weakly convex lateral surfaces by similarly weak lateral carinae. Eyes prominent, width about two-thirds length. First antennal joint less than a quarter as long as the eye. Pronotum and prosternum cylindrical, separated by a subobsolete line, pronotal surface thickly tuberculate and with fine transverse rugae, laterad furnished with a number of larger tubercles, the prosternum almost as heavily tuberculate in cephalic half, very weakly tuberculate in caudal half. Apterous. Mesonotum and metanotum with a weak median rugulose line; proximal portion of abdomen impresso-punctulate, this subobsolete in other portions. Abdomen moderately clavate distad, penultimate sternite truncate, the subgenital plate reflexed. Caudal femora tuber-

[46] Belonging to the Scudder Collection of the Museum of Comparative Zoology, but at present before us.

culate proximad, the tuberculations arranged in longitudinal lines heavier, particularly ventrad. Caudal tibiae lacking a dorso-internal distal spine,[47] the last of that series a slightly greater distance from the apex of the tibia than from the preceding spine.

General coloration bister; the head, median portion of pronotum, all of mesonotum and metanotum, apices of caudal limbs and heavier pronotal tubercles paler, tawny olive. Of these paler portions the head proximad shows greatest suffusion.

Length of body, 87; length of vertex, 1.7; length of pronotum, 27.1; least width of pronotum, 1.7; length of cephalic femur, 15.7; length of caudal femur, 31.7; greatest width of caudal femur, 2 mm.

The type is unique.

ACRIDINAE

Group *Hyalopteryges*

Truxalis brevicornis (Johannson)

1764. [*Gryllus*] *brevicornis* Johannson, Amoenit. Acad., VI, p. 398. [North America.]

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 2 ♂.

These specimens are brown, with face, dorsal surface and median limbs green.[48]

Paratruxalis filiatus (Walker)

1870. *Chrysochraon filiatus* Walker, Cat. Dermapt. Saltat. British Mus., IV, p. 785. [♂; Santarem, Brazil.]

Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, IV, 25, 1914, (M. A. Carriker, Jr.), 2 ♂.

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 1 ♀.

The males show a depauperate condition more decided than the smallest Paraguayan or Argentinian examples before us, in all other respects being typical. None show any divergence toward *P. filiatus minor*.

[47] Armed with sixteen and seventeen dorso-external and ten dorso-internal spines.

[48] The species has recently been fully discussed as found in the United States, Trans. Amer. Ent. Soc., XLVIII, pp. 103 to 108, (1922).

The known range of the species is greatly extended northwestward by these records.[49]

In the present genus when the lateral carinae of the pronotum are heavy they are continuous, when weak they are offset at the principal sulcus, continued on the metanotum from a distinctly more lateral point, with occasionally a very feeble parallel and adjacent carina indicated as a continuation of these carinae cephalad. This feature is a matter of individual variation,[50] comparable to the differences found in the pronotal carinae in the Acridine genera *Eritettix* and *Macneillia*. The specimens here recorded have the lateral carinae heavy and continuous.

Group *Amblytropidiae*

Amblytropidia insignis new species (Plate XI, figures 18 and 19.)

This species, one of the largest of the genus, is apparently nearest *A. robusta* Bruner, differing in the male in having the carinae of the fastigium more decided, the lateral carinae straight, not weakly convex, to the resultantly more abruptly blunted and narrower apex, the form very slightly but appreciably less elongate[51] and tegmina which normally reach or extend slightly beyond the apices of the caudal femora.[52] In the female it differs in the very slightly but distinctly more robust form, the same fastigial features as shown by the male but in this sex less distinctive, the more decided impressed longitudinal lines of the occiput, the slightly more impressed lateral portions of the pronotal disk, and the tegmina which reach or extend very slightly beyond the apices of the caudal femora.[53]

[49] This insect, *Orphula pagana* of authors but not of Stål, has been fully discussed and properly assigned by Rehn, Trans. Amer. Ent. Soc., XLII, p. 275, (1916).

[50] As has been noted by Rehn, Proc. Acad. Nat. Sci. Phila., 1913, p. 314, (1913).

[51] Comparison of series alone makes this distinction possible, slight individual variation occurring in both species.

[52] In *robusta* the tegmina normally reach only to the base of the genicular areas of the caudal femora, but in one specimen from Tijuca, Brazil, in the Academy Collection, these organs extend well beyond the apices of the caudal femora.

[53] In females of *robusta* the apices of the tegmina normally fall distinctly short of the bases of the genicular areas of the caudal femora.

Relationship is also shown to *A. trinitatis* Bruner[54] and to *A. chapadensis* Rehn,[55] the present insect differing in the male fastigium with lateral carinae fully as well developed as the decided median carina; in the female in the average larger size and the distinctly more robust form, the length of the prozona equalling its width and the fastigium with lateral carinae fully as well developed as the moderately decided median carina.

Affinity with *A. magna* Bruner is also found, the male of that species[56] having the fastigium similar but more produced, the size decidedly larger and the form decidedly more slender.

It is clear that Giglio-Tos has determined material of this species as *A. ferruginosa* Stål.[57] The female sex of that species is widely distinct[58] in having very weak carinae of the vertex, occiput more strongly impresso-punctate, pronotum decidedly shorter with disk very heavily but minutely impresso-punctulate, its lateral carinae more bluntly rounded and showing a distinct divergence caudad and proportionately shorter limbs.

Type.—♂; Gatun, Canal Zone, Panama. August 16 to 22, 1916. (D. E. Harrower.) [Hebard Collection, Type no. 457.]

Size medium for the genus, form moderately robust. Head with frontal costa broad with margins parallel, punctate dorsad, shallowly sulcate below antennal bases. Fastigium decidedly projecting for genus, lateral carinae decided, their external margins almost straight from point of convergence to the blunt apex, which is narrow for the genus, equalling half the interocular width, median carina decided, weak but percurrent on occiput where it is bordered on each side by a very weak, irregular, longitudinal ridge, which is in turn externally bordered by a shallowly depressed line. Eyes large and prominent, more so than in *robusta* or *trinitatis*. Antennae slightly shorter than caudal tibiae. Pronotum with disk moderately impresso-punctate, caudal margin moderately angulato-produced, the sides distinctly though not strongly concave; principal sulcus cutting median carina distinctly caudad of median point, the median carina decided, lateral carinae distinct and subparallel.

[54] As shown by a large unreported series at hand from Venezuela and Trinidad.

[55] From the description and one female in the author's collection, from Sapucay, Paraguay.

[56] A paratype is in the author's collection.

[57] Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, no. 301, p. 2, (1897).

[58] As shown by a female from Franca, Sao Paulo, Brazil, in the Academy Collection.

Tegmina and wings fully developed, reaching the apices of the caudal femora. Distal portion of abdomen showing no differentiation from *robusta* or *trinitatis*. Interspace between mesosternal lobes quadrate. Caudal femora moderately elongate and very robust proximad. Caudal tibiae with numerous (twelve and thirteen) dorso-external spines.

Allotype.— ♀ ; same data as type, but taken July 25 to 31, 1916. [Hebard Collection.]

Size much larger, form more robust than in male. Fastigium and occiput as in that sex, except for being decidedly wider, with carinae well marked but not as strong. Tegmina extending to apices of caudal femora. Interspace between mesosternal lobes very feebly longitudinal, nearly subquadrate. Caudal tibiae with numerous (thirteen and thirteen) dorso-external spines.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Width of pronotum	Length of tegmen	Length of caudal femur	Width of caudal femur
Gatun, Panama, *type*	19	4.2	2.2	16.7	13.2	3
Gatun, Panama, *paratype*	17.8	3.8	2	14.8	12.8	2.8
Gatun, Panama, *paratype*	21	4.4	2.6	17.4	14.8	3.3
Cincinnati, Colombia	20	4.1	2.1	15.6	13.3	2.9
♀						
Gatun, Panama, *allotype*	31.8	6.8	3.9	22.4	19	4.6
Gatun, Panama, *paratype*	28.8	5.8	3.7	20.3	18.2	4
Gatun, Panama, *paratype*	33.7	6.4	3.9	22.1	20.3	4.7

The extremes in the series of paratypes are given above. The series shows no unusual variation, rare specimens alone having the tegmina and wings noticeably shorter or longer than the average.

Coloration. Male. Type. Head, except face and eyes, and entire pronotum sepia showing a distinct brownish olive tinge, this strongest laterad. Eyes cinnamon brown. Face olive lake, the antennae in brief proximal portion this color, thence blackish. Tegmina blackish sepia. Mesonotum and metanotum yellowish olive. Wings transparent, clear hyaline, suffused with brown distad. Dorsal surface of abdomen english red, shading ventro-laterad to deep chrome, ventral surface deep

chrome. Cephalic limbs snuff brown. Median limbs snuff brown with dorsal surface of femora buffy. Caudal femora brilliant vinaceous rufous, almost brazil red, becoming darker dorsad and distad, dorsal margin buffy, genicular areas black. Caudal tibiae prout's brown, becoming mummy brown in distal third, caudal tarsi brown.

Some specimens are slightly darker, others distinctly paler, these with the tinge of olive more decided. In many the caudal femora are much embrowned and in all of the poorly preserved specimens the brilliant reds of the abdomen and caudal femora have been lost.

Female. General coloration brown. Head and pronotum verona brown, deeper laterad. Tegmina deep verona brown with inconspicuous flecks of warm sepia. Wings transparent, hyaline, clear or pale glass green, with distal portion of anterior field suffused with bister. Mesonotum and metanotum washed with yellowish olive. Limbs and abdomen verona brown, except caudal femora which shade dorso-laterad to warm sepia and have their dorsal surfaces cinnamon buff.

Another color phase occurs in which the dorsal surface of head and pronotum is strikingly paler, cinnamon buff, the tegmina clay color, the lateral portions and limbs snuff brown. The females show a moderate range between the extremes of intensification and recession, usually having the dorsal paler than the lateral surfaces, this occasionally is decided contrast. In two nearly adult females this contrast is very great.

Specimens Examined: 68; 42 males, 18 females and 8 immature individuals.

Gatun, Canal Zone, Panama, VII, 12 to VIII, 22, 1916, (D. E. Harrower), 40 ♂, 16 ♀, *type, allotype* and *paratypes*, 8 juv. [Hebard Collection.]

Zone limit five miles west of Empire, C. Z., Panama, IX, 14, 1913, (M. Hebard; among grasses in open spot in jungle), 1 ♂, [Hebard Collection].

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia, VII, 10, 1913, (M. A. Carriker, Jr.), 1 ♂.

Susumuco, Cundinamarca, Colombia, X, 10, 1917, (from A. Maria), 1 ♀.

Villavicencio, Intendencia del Meta, Colombia, V, 1917, (from A. Maria), 1 ♀.

Group *Orphulellae*

CUMARALA new genus

This genus is remarkable in that, though showing Orphulelline features the strongest, others are more like those characteristic of the Hyalopterygids, while still others strongly resemble certain features found in the genus *Machaerocera*.

Nearest affinity is with *Thyriptilon*, the present genus agreeing in general appearance, straight sides of the fastigium in female

(a hyalopterygoid feature), weakly ensiform antennae, lateral carinae of pronotum distinctly diverging on metazona, and shape and distinctive coloration of the caudal femora. It differs in having the entire distal dorsal portion of the fastigium impressed (much as in *Machaerocera*); frontal costa sulcate nearly to the fastigio-facial angle (the entire portion above the antennae not sulcate in *Thyriptilon*, the sulcation percurrent in *Machaerocera*); more appreciably though weakly ensiform antennae, which in the female sex are very much more elongate; lateral carinae of pronotum broken, weak and feebly convergent to first sulcus in male, indistinct in female; wings with fenestrate area narrower in male, these organs suffused and with proximal portion of radiate field colored (more as in *Machaerocera*); genicular lobes of caudal femora acute (as in Hyalopterygids) and caudal metatarsus equalling the last tarsal joint in length (in *Thyriptilon* much longer than the last joint).

Genotype.—Cumarala annectens new species.

The following features are considered of generic value, in addition to those noted above. Head no wider than pronotum, rather high, dorsal surface moderately ascendant cephalad, occiput moderately convex (more so than in *Thyriptilon*). Fastigium with sides straight, convergent, high, meeting at much less than a right angle, the dorsal surface distad impressed caudad to point above ocelli, lacking a medio-longitudinal carina, lateral foveolae moderately indicated. Eyes prominent, not decidedly pointed dorsad, considerably shorter than cheeks. Antennae subensiform, with proximal joints distinctly flattened, length considerably greater than that of head and pronotum. Face strongly oblique. Pronotum with median carina prominent throughout, cut by principal sulcus; caudal margin of disk obtuse-angulate with apex truncate. Tegmina and wings fully developed, extending moderately beyond apex of abdomen. Tegmina with apex oblique truncate, but with angles rounded; costal margin moderately dilated. Wings colored. Caudal femora moderately stout. Caudal tibiae with numerous (nine) external and (ten) internal spines on the dorsal margins, which spines are moderately long distad.

Cumarala annectens new species (Plate XII, figures 14, 15 and 16.)

Nearest affinity is found in *Thyriptilon vitripenne* Bruner, that insect differing widely in the numerous features discussed above.

Type.— ♀ ; Cumaral, Intendencia del Meta, Colombia. July, 1916. (From A. Maria.) [Hebard Collection, Type no. 456.]

In addition to the features given in the generic diagnosis, the following are noted. Form more robust than in *T. vitripenne.* Lateral lobes of pronotum with dorsal length slightly greater than depth, median vertical sulcus decided in ventral two-thirds. Ovipositor short, much as in *T. vitripenne.*

Allotype.—♂; Pueblo Nuevo de Ocaña, Santander, Colombia. September 3, 1916. (M. A. Carriker, Jr.) [Hebard Collection.]

This sex differs from the female as follows. Size decidedly smaller, form more slender. Fastigium narrower, with apex similarly sharply rounded, its lateral margins feebly convex. Median vertical sulcus of pronotal lateral lobes strongest mesad. Wings with a decided fenestrate area. Subgenital plate tapering to a bluntly truncate apex with angles rounded.[59]

Coloration. Female. Dorsal surface of head, pronotum and tegmina immaculate snuff brown, lateral portions blackish bister, on head and pronotum shading ventrad to snuff brown. Antennae blackish bister. Eyes argus brown. Wings transparent, suffused with sepia except in proximal half of radiate field, where they are suffused with primrose yellow. Limbs snuff brown, darker distad. Caudal femora snuff brown shading to bister in genicular areas and with the narrow ventro-external face strikingly blackish bister. The La Palmeta female is paler, with dorsal surface clay color.[60]

Male. Face warm buff with a vertical median suffusion of brown; antennae, genae, lateral lobes of pronotum and lateral portions of tegmina dark mummy brown. Eyes chestnut brown. Dorsal surface of head and pronotum (the lateral portions of which are narrowly dark mummy brown), ventral surface, abdomen and caudal femora (except genicular portions which are blackish) clay color. Dorsal surface of tegmina water green. Cephalic and median limbs clay color suffused with brown, this heavy at the femoral apices and distad. Some of the males have the dorsal surface of head, pronotum and tegmina uniform clay color, others have it light turtle green. The wings in this sex are much less heavily suffused than in females.

The measurements of the allotype for males, of the type for females, are given first, followed by the extremes in the series.

Length of body, ♂, 18.7, 16.3 to 18.5; ♀, 30.5, 28.7 to 32.3: length of pronotum, ♂, 4, 3.9 to 4.1; ♀, 5.8, 6 to 6.2: caudal

[59] In *Thyriptilon* with apex more sharply rounded and showing a strong but delicate medio-longitudinal carina dorsad.

[60] This specimen appears to have been killed when teneral, the proximal portions of the wings being buffy.

width of pronotum, ♂, 2.3, 2.3 to 2.4; ♀, 3.8, 3.7 to 3.8: length of tegmen, ♂, 16, 16.3 to 17.8; ♀, 25, 22.5 to 25.7: greatest tegminal width, ♂, 3; ♀, 4.5: length of caudal femur, ♂, 12.2, 12.2 to 13; ♀, 17 to 17.8: greatest width of caudal femur, ♂, 2.7; ♀, 3.5 mm.

Specimens Examined: 11; 8 males, 3 females.

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 7 ♂, *type* and *paratypes*.

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 1 ♂, 1 ♀, *paratypes*.

Susumuco, Cundinamarca, X, 1918, (from A Maria), 1 ♀, *paratype*.

Cumaral, Intendencia del Meta, VII, 1916, (from A. Maria), 1 ♀, *type*.

Orphulella boucardi (Bruner)

1874. *Zonocerus*? *bilineatus* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 268. [♀, eastern slope of Peruvian Andes.]

1896. [*Orphulella*?] *bilineatus* Scudder, Proc. Boston Soc. Nat. Hist., XXVII, p. 210. (Questioned generic assignment.)

1904. *Linoceratium boucardi* Bruner, Biol. Cent.-Amer., Orth., II, p. 84. [♂, ♀; Rio Sarstoon, British Honduras; Panama; Don (nec San) Diego, Magdalena, Colombia.]

1906. *Orphulella* [sic] *chipmani* Bruner, Journ. New York Ent. Soc., XIV, p. 149. [♂, ♀; Interior of Island of Trinidad.]

1911. *Orphulella peruna* Bruner, Ann. Carnegie Mus., VIII, p. 16. [New name for [*Orphulella*?] *bilineatus* Scudder.]

1911. *Linoceratium australe* Bruner, Ann. Carnegie Mus., VIII, p. 20. [♂, ♀; Corumbá, Brazil.]

1916. *Orphulella boucardi* Rehn, Trans. Amer. Ent. Soc., XLII, p. 277. (Generic assignment and full discussion of names, synonymizing *chipmani* and *australe*.)

In addition to large series which have been previously recorded and the material here reported, we have material of the species from Ecuador and Peru, which enables us to place *Orphulella peruna* Bruner also in the present complicated synonymy, suggested as a possibility by Rehn in 1916. Bruner's three synonyms are apparently in large part attributable to failure to recognize the color variation developed in this species.

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 7 ♂, 5 ♀, 1 juv. ♂.

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 3 ♂, 2 ♀.

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 1 ♂, 1 ♀.

Buenaventura, El Valle, V, 7 and 8, 1914, (H. S. Parish), 1 ♂, 1 ♀, [A. N. S. P.].

La Cumbre, Cordillera Occidental, El Valle, V, 15 and 19, 1914, (H. S. Parish), 1 ♂, 2 ♀, [A. N. S. P.].

La Union, Huila, XII, 1913, (from A. Maria), 1 ♂.

La Sierra, Cauca, III, 1, 1912, (Allen and Lloyd), 1 ♂, [Cornell Univ.].

The uniformly pale caudal femora, except for usual suffusion at the genicular areas, solidly very dark lateral portions of the tegmina and dorsal half of sides of head and pronotum, are features which separate readily all of the numerous color phases of this small species from the innumerable color phases developed in *O. punctata.*

Orphulella melanopleura new species (Plate XII, figure 17.)

This comparatively large and handsome insect is readily separated from the numerous South American members of the genus by the genae, lateral lobes of the pronotum and lateral portions of the tegmina which are very dark; in the females the face is paler with a dark median, vertical, suffused bar, in the males the face is pale, buffy, in sharp contrast with the very dark occiput and genae.

Nearest affinity is shown to the Guatemalan insect described by Bruner as *Orphulella walkeri,*[61] renamed *O. losamatensis* by Caudell. That insect agrees throughout in the distinctive type of coloration, but has the vertex as in *O. boucardi* (Bruner) and is no larger than the average for that species.

Nearest affinity among the South American species is with *boucardi,* that insect differing in the average smaller size, ventral portions of the genae and lateral lobes of the pronotum as pale as the face, the vertex narrower, with width between lateral angles of fastigium in female no greater than perpendicular line from that point to the apex and in the even convexity of the caudal margin of the pronotal disk.

[61] Bruner's *Orphulella walkeri* (Biol. Cent.-Amer., Orth., II, p. 78, (1904)) was proposed for *Stenobothrus mexicanus* Walker, nec Saussure, should that name prove distinct from *Orphulella punctata* (DeGeer). Kirby has placed that insect as a synonym of *punctata,* and *walkeri,* in consequence, likewise falls as a synonym. Bruner's *Orphulella walkeri* (Ohio Naturalist, VII, p. 11, (1906)) is a distinct species, renamed *Orphulella losamatensis* by Caudell (Proc. Ent. Soc. Washington, XI, p. 113, (1909)), for which we here select as single type, a male, taken at Los Amates, Guatemala, February 22, 1905, [Hebard Collection, Type no. 255].

Type.—♂; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 881.]

Size large and form average for the genus. Vertex very faintly widening to lateral angles, the width there slightly greater than perpendicular distance to apex of fastigium; surface between the blunt but distinct lateral carinae moderately impressed. Frontal costa showing only a trace of sulcation above and below the median ocellus. Antennae elongate and slender, proportionately decidedly longer than in *boucardi*. Pronotum with lateral carinae weak, nearly parallel to principal sulcus, then divergent and feebly convex; median carina slightly heavier, particularly on metazona, cut only by principal sulcus; prozona distinctly longer than metazona; caudal margin of disk convex, but with this weak laterad, so that, unlike in *boucardi*, angulation is suggested. Tegmina and wings fully developed (extending to or briefly surpassing the apices of the caudal femora), rounded distad. Interspace between mesosternal lobes distinctly longer than wide, narrower than in *boucardi*.

Allotype.—♂; same data as type. [Hebard Collection.]

Differs from male as follows. Size larger, form less slender. Vertex broader and shorter, width at lateral angles distinctly greater than distance to apex of fastigium. Antennae proportionately shorter. Caudal margin of pronotal disk with median convexity narrower and angulation, in consequence, more strongly suggested. Interspace between mesosternal lobes distinctly broader than long.

Color features of considerable diagnostic value appear to exist. Genae, lateral lobes of pronotum, pleura and lateral portions of tegmina blackish brown, except for a fleck of buffy caudad on pleura. The dorsal margins of the lateral lobes often narrowly black. Face and palpi pale buff in males, mouthparts suffused with brown. Face, mouthparts, occiput, dorsal surface of pronotum and tegmina light brown, varying in shade, in females. Occiput, dorsal surface of pronotum and tegmina lighter brown than lateral portions in males, or light green in that phase which is developed in both sexes. Abdomen blackish proximo-laterad, elsewhere buffy in males; brown in females. Limbs immaculate brown, the median femora green in individuals of the green phase, the caudal femora with genicular areas dark brown in all. Caudal tibiae dark brown, usually with a distinct buffy annulus proximad.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Andagoya, *type*.....	14.5	3	1.9	12.2	9.9
Andagoya, *paratypes*.....	14.8–15.5	3–3.3	1.9–2.1	12.7–13.2	9.9–10.3
Boca Murindo, *paratypes*.....	15.2–16.8	3.2–3.7	2–2.4	13.8–15.8	10.2–11.4
Buenaventura.....	14.5–14.8	2.9–3	1.9–1.9	13–12.4	9.8–9.9
♀					
Andagoya, *allotype*..	20	4	2.7	16.8	12.3
Andagoya, *paratypes*.	19.5–21	3.8–4.1	2.7–2.8	15.3–17.7	11.9–13.3
Boca Murindo, *paratypes*.....	21–22	4–4.2	2.7–2.8	15.8–18.2	12.7–13.3

Specimens Examined: 47; 27 males and 20 females.

Andagoya, Antioquia (Chocó), IV, 22, 1918, (M. A. Carriker, Jr.), 14 ♂, 12 ♀, *type*, *allotype*, *paratypes*.

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 10 ♂, 8 ♀, *paratypes*.

Buenaventura, El Valle, V, 8, 1914, (H. S. Parish), 3 ♂, [A. N. S. P.].

Orphulella punctata (DeGeer)

1773. *Acrydium punctatum* DeGeer, Mém. l'Hist. Ins., III, p. 503, pl. 42, fig. 12. [[♀], Surinam [= Dutch Guiana].]

1861. *Ox[ycoryphus] mexicanus* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 314. [♂, ♀; Mexico.]

1904. *Orphulella meridionalis* Bruner, Biol. Cent.-Amer., Orth., II, p. 81. [♂, ♀; Costa Rica.]

1904. *Orphulella costaricensis* Bruner, Biol. Cent.-Amer., Orth., II, p. 82. [♂, ♀; San José, Costa Rica.]

Careful examination of all the tropical American material before us shows the presence of a widespread and exceedingly variable species, generally distributed from Mexico to the Argentine. Such variation in size, pronotal contour and coloration has often been mistaken for differences of valid specific differentiation, and has led to an unusually complex synonymy. Kirby has noted the synonymy of *Stenobothrus mexicanus* Walker and *Orphulella walkeri* Bruner of 1904, from Mexico, but failed to note that the same name was used by the latter for a distinct Guatemalan species the same year, that insect having been subsequently renamed *losamatensis* by Caudell.

From the very large Mexican series at hand and Saussure's description, we believe that his *Oxycoryphus mexicanus* is a mere variant of *punctata*. It is likely that his *Oxycoryphus totonacus* is also a synonym, as Walker's Honduran *Stenobothrus viridissimus* may also be. Bruner's types of *meridionalis* and *costaricensis*, in the author's collection, are evidently conspecific, showing minor differences which are attributable to mere individual variation of no unusual degree.[62]

Mamatoco, Magdalena, XII, 1917, (M. A. Carriker, Jr.), 2 ♀.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 19, 1913, (M. A. Carriker, Jr.), 1 ♀.

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, XI, 1917, (M. A. Carriker, Jr.), 3 ♂, 1 ♀.

Buenaventura, El Valle, V, 7, 1914, (H. S. Parish), 2 ♀, [A. N. S. P.]

Caldas, El Valle, V, 9 to 14, 1914, (H. S. Parish), 9 ♂, 5 ♀, [A. N. S. P.]

La Cumbre, Cordillera Occidental, El Valle, V, 14 to 19, 1914, (H. S. Parish), 2 ♂, 5 ♀, [A. N. S. P.]

Cali, El Valle, V, 24 to 29, 1914, (H. S. Parish), 5 ♂, 1 ♀, [A. N. S. P.]

La Union, Huila, XII, 1913, (from A. Maria), 1 ♂, 4 ♀.

Las Mesitas, Cundinamarca, V, 1918, (from A. Maria), 1 ♀.

Fusagasuga, Cundinamarca, XII, 1918, (from A Maria), 1 ♀.

The great diversity of color and color pattern in this common and widely distributed species is well shown by the present series. Dark or light brown, little or greatly mottled, brown with dorsal surface pale or green, and uniform green are the more striking phases, each of which varies to form innumerable minor differences.

Group *Compsacres*

Compsacris aspasma new species (Plate XIII, figures 1 and 2.)

The male of the present species, compared with the unique male type of *C. brevipennis* (Rehn), is found to show a general similarity of color pattern, similar but slightly less slender form,

[62] That author's key to the genus, in the Biologia, is worthless in greater part. A large portion of the material there recorded is before us and the confusion of determinations is great, while in the key many valueless characters are used.

fastigium slightly wider and ascendent, not weakly declivent, pronotum not smooth, mesosternal lobes not feebly transverse and tegmina much more decidedly reduced.

Type.—♂; Hacienda Cinncinati, Sierra San Lorenzo, Magdalena, Colombia. Elevation, 4000 to 5000 feet. July 10, 1913. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 458.]

Size medium, form slender. Head with dorsal surface smooth, ascending to fastigium, the dorsal surface of which is nearly horizontal. Lateral margins of fastigium forming an angle distinctly less than rectangulate, with apex broadly and very bluntly rounded, length about equal to greatest width, impressed only along its bluntly carinate margins; foveolae lateral, subobsolete, not impressed; face strongly retreating; frontal costa moderately broad, shallowly sulcate, this not continued dorsad above dorsal margin of antennal bases. Eyes prominent. Antennae twice the combined length of head and pronotum, depressed but not expanded proximad, cylindrical distad. Pronotum short, almost evenly convex dorsad; median carina weak, percurrent, traces of strongly convergent carinae, cephalad and caudad, scarcely perceptible; caudal margin of disk transverse, showing a very feeble convexity; prozona smooth but showing a few impressed punctae, metazona cribroso-punctulate; lateral lobes distinctly longer than deep, caudal margin very feebly concave. Interspace between mesosternal lobes quadrate. Tegmina greatly reduced, elongate ovate, about half as long as abdomen. Wings vestigial, not reaching half way to apex of tegmen. Supra-anal plate shield-shaped, at apex briefly triangularly produced. Cerci simple, styliform. Subgenital plate conical, slightly compressed latero-dorsad to near apex, which is rounded. Ventral surface, tibiae and tarsi moderately supplied with long hairs. Caudal femora very elongate, moderately expanded proximad, genicular lobes acute, the internal decidedly so. Caudal tibiae with (ten and eleven) dorso-external spines.

Allotype.—♀; same data as type. [Hebard Collection.]

Size much larger than male, form proportionately slightly more robust. Fastigium slightly broader and blunter, not quite as long as greatest width. Frontal costa broader, with sulcation very shallow and becoming obsolete between the antennal bases where the frontal costa is somewhat widened. Pronotum with strongly convergent, straight, lateral carinae well developed cephalad and caudad, the caudal pair extending almost to the heaviest sulcus of the prozona, leaving a space without lateral carinae which is slightly shorter than one of the cephalic lateral

carinae. Ovipositor valves short and heavy, suddenly and sharply curved near the immediate apices.

Coloration of male. *Type.* Antennae black with minute apical joint buffy. Head with a medio-longitudinal band of olive yellow (mustard yellow in paratype), which is continued on pronotum and percurrent, laterad black with a greenish tinge to below eyes, face dark greenish olive speckled with mustard yellow and on each side with a band of mustard yellow commencing below the eye and running along its margin, thence broadening and margining the ventral portion of the genae, this continued on the pronotum, there margining the lateral lobes and at its widest scarcely equalling one-fourth the depth of the lobe. Pronotum, except dorsal and latero-ventral bands, black tinged with green. Dorsal portion of tegmina colored as dorsal stripe, lateral portions suffused with cameo brown, becoming paler distad. Abdomen hazel becoming vinaceous-rufous distad. Cephalic and median limbs greenish. Caudal femora mahogany red shading to english red distad, with a broad pregenicular annulus of primuline yellow briefly beyond and genicular area black. Caudal tibiae black proximad, then yellowish opposite femoral annulus, thence brownish.

Coloration of female. *Allotype.* General coloration walnut brown. Antennae in proximal half dorsad pinkish cinnamon, otherwise as in male. Head and pronotum with a medio-longitudinal band of cinnamon, very narrowly bordered on occiput and broadly on pronotum with velvety blackish carob brown; on the pronotum in this area the cephalic and caudal lateral carinae are sharply defined in cinnamon. Tegmina walnut brown showing a few darker flecks.

The measurements of the male type are given first. Length of body, ♂, 17 and 16; ♀, 25.2: length of pronotum, ♂, 3.6 and 3.4; ♀, 5.2: total pronotal width, ♂, 2.8 and 2.7; ♀, 4.8: length of tegmen, ♂, 5.2 and 4.7; ♀, 7.2: length of caudal femur, ♂, 13.1 and 12.1; ♀, 17.9: width of caudal femur, ♂, 2.6 and 2.4; ♀, 3.5 mm.

In addition to the described pair, a single paratypic, male, bearing the same data, is at hand.

Group *Peruviae*

Peruvia nigromarginata (Scudder)

1875. *Machaerocera nigromarginata* Scudder, Proc. Boston Soc. Nat. Hist., XVII, p. 268. [♂, Eastern slope of Peruvian Andes.]

This species was, for some time, generally recognized as *Toxopterus miniatus* Bolivar.[63]

[63] The synonymy was established by Rehn, Trans. Amer. Ent. Soc. XLII, p. 280, (1916).

Susumuco, Cundinamarca, (from A. Maria), 2 ♂.

Length of body, 18.1 and 18.7 mm.; length of pronotum, 4 and 4.1; length of tegmen, 18 and 17.8.

The present record extends the known range of the species far north of regions from which it had previously been recorded.

Group *Scyllinae*

Scyllina cyanipes (Fabricius)

1775. [*Gryllus*] *cyanipes* Fabricius, Syst. Ent., p. 292. [America.]

1860. *Gomphocerus* (*Epacromia*) *peragrans* Stål, Kongl. Svenska Freg. Eugenies Resa, Zool., I, p. 343. [♂, ♀; Puna [Island, Ecuador].]

1861. *St*[*enobothrus*] *gregarius* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 318. [♂, St. Thomas, [West Indies]; ♀, Haiti, [West Indies].]

After careful comparison of a series of four hundred and forty-one specimens, representing those species of the genus which normally have the distal portion of the caudal tibiae cyaneous, we are satisfied that a large series from the West Indies and another from Panama represent Fabricius' *cyanipes*.

Close examination of these shows no feature by which the West Indian and Panamanian material may be separated even racially. We, therefore, are obliged to assign Saussure's *gregarius* to the present synonymy without qualification.

Stål's Ecuadorean *peragrans* we believe was described from discolored material which had lost its natural caudal tibial coloration. The description agrees in all other features so closely that we feel little hesitancy in placing the name in the present synonymy.

Western Colombia, 1 ♀.

This specimen agrees in all respects with Panamanian material except that the caudal tibiae are light jasper red (buffy latero-proximad), changing in distal third to hydrangea red (this portion not as contrasted, not cyaneus or violet blue as is usual in the species). Such difference may be attributed to individual variation.

The present species may be distinguished from *viatoria* by the following structural characters. Size averaging decidedly smaller. Fastigium and frontal costa forming a broadly rounded but distinct fastigio-facial angle. Fastigium triangularly impressed in distal portion, with the usual transverse crescentric impression mesad absent or very weak. Rectangular lateral

foveolae present though very weak, weakly impressed with angles rounded and margins broad and bluntly rounded.

The measurements of the present female are; length of body, 31.5; length of pronotum, 5.6; caudal width of pronotal disk, 4.2; length of tegmen, 28.2; length of caudal femur, 18.8; greatest width of caudal femur, 4.8 mm.

Scyllina viatoria cyanomera new subspecies

1904. *Plectrotettix calidus* Bruner (in part), Biol. Cent.-Amer., Orth., II, p. 101. [♂, ♀; Costa Rica.]

The species *S. viatoria* (Saussure) may be distinguished from *S. cyanipes* (Fabricius) by the following characters. Vertex rounding so broadly into frontal costa that a fastigio-facial angle can scarcely be said to exist. Fastigium with a weak rounded impression meso-distad, this strongest at its transverse median crescentric impression. Lateral foveolae practically obsolete, appearing only as a smooth broadening on each side of the frontal costa and fastigium, at their juncture. Both species have the longest (ventro-internal) spur of the caudal tibia distinctly less than twice as long as the dorso-internal, with claw-like apex unspecialized.

The present handsome geographic race occurs in the highlands of the Sierra Nevada de Santa Marta, Colombia, and probably in similar environment in Costa Rica.[64]

Type.—♂; Macotama Valley above San Miguel, Sierra Nevada de Santa Marta, Colombia. Elevation, 7000 to 8000 feet. April 3, 1914. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 912.]

Size and form agreeing with the optimum development[65] found in typical *viatoria*. The series of one hundred and seven specimens before us agree with the type in having the entire ventral surface of the caudal femora and slightly more than the distal third of the caudal tibiae rich and deep cyanine blue. In typical *viatoria* the ventral surface of the caudal femora is buffy, sometimes suffused but never strongly so; while the distal portion of the caudal tibiae is never as brilliantly or as deeply cyaneous. Similarity is shown by the smaller and more robust race of the Central Plateau of Mexico, *S. viatoria excelsa* (Bruner),

[64] Bruner failed to note a decided difference in his Costa Rican material, when compared with the other specimens which he described as *calidus*, a synonym of *viatoria viatoria*.

[65] Described as *Plectrotettix calidus* by Bruner.

but in that race the ventral surface of the caudal femora and apices of the caudal tibiae are blackish showing a tinge of cyaneous, or dull cyaneous, or but weakly suffused with blackish. In the type the caudal tibiae are buffy to their dark distal portion, with dorsal surface faintly tinged with orange (which in the series individually varies to pink[66]).

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur	Width of caudal femur
Macotama Valley, *type*	31.8	6.3	4.7	33.5	21.2	5
Macotama Valley, *paratype*	29.2	5.9	4.3	29.4	18.9	4.2
Taquina, *paratype*	32	6.3	4.8	34.8	21.3	5
"Costa Rica"	30.3	5.8	4.1	29	21.8[67]	5.2[67]
♀						
Macotama Valley, *allotype*	37.8	7.1	5.4	37.8	23.9	5.2
Macotama Valley, *paratype*	36.3	6.8	5.3	35.8	22.4	5.3
Taquina,	43.3	7.6	6.1	41	25.2	5.9
"Costa Rica"	43.1	7.9	5.9	37	27[67]	6.3[67]

The series before us shows great color variation, but all are decidedly intensive. The medio-longitudinal pale band is very conspicuous in many, weak in some and absent in many. The sub-ocular dark band or patch and that of the pronotal lateral lobes varies from very extensive (many) to absent (many). The dorsal dark bars of the caudal femora are very broad and deep in many, but individually variation occurs to the condition where such markings are absent.

The large size and dark coloration of the series gives an appearance suggesting much wider separation from typical *viatoria* than is the case.

Specimens Examined: 107; 51 males, 56 females.

Paramo de Macotama, Sierra Nevada de Santa Marta, Magdalena, 10,000 feet, IV, 10, 1914, (M. A. Carriker, Jr.), 1 ♀.

[66] In the Costa Rican specimens, however, this surface is more richly colored, orange chrome deepening to coral red distad.

[67] The series of typical *viatoria* at hand indicates that decided differences in femoral size and proportions should be attributed to individual variation.

Macotama Valley above San Miguel, Sierra Nevada de Santa Marta, Magdalena, 7000 to 8000 feet, IV, 3, 1914, (M. A. Carriker, Jr.), 18 ♂, 19 ♀, *type, allotype, paratypes.*

Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, 6500 feet, IV, 25, 1914, (M. A. Carriker, Jr.), 31 ♂, 34 ♀, *paratypes.*

Costa Rica, (M. A. Carriker, Jr.), 1 ♂, 1 ♀, *paratypes* of *calidus.*

Scyllina alticola new species (Plate XIII, figures 3 and 4.)

This insect is closely related to *S. pratensis* Bruner.[68] These species and *S. smithi* Rehn,[69] belong to a group in which the species are relatively small and slender with caudal tibiae red, this becoming more decided distad but without trace of purplish tinge. The females are very decidedly more slender than that sex in *pratensis.*

Compared with *pratensis,* the present insect is found to agree closely in size; to have the fastigium shorter and blunter, the rounded angulation of its lateral carinae at the dorsal apices of the eyes (not at a point appreciably beyond this as in *pratensis)*; the frontal costa with sulcation similarly not continued above the median ocellus, but decidedly broader and showing scarcely any narrowing above the antennae to its intersection with the fastigium (in *pratensis* narrowing distinctly to that point); the tegmina averaging more elongate, normally extending a greater distance beyond the more elongate caudal femora, and the ventro-internal spur of the caudal tibiae unspecialized (occasionally with apex above its distal claw very feebly convex produced in *pratensis*).

Compared with *smithi,* the present species agrees in the vertex and frontal costa, differing in the average slightly smaller size of the male sex and in both sexes in the appreciably less slender form, subquadrate interspace between the mesosternal lobes (in *smithi* this space is longer than broad) and the unspecialized and much shorter ventro-internal spur of the caudal tibiae (which has its apex above the distal claw decidedly produced in *smithi*).

The dorsal portion of the frontal costa in both *alticola* and *smithi* is very broad for these very slender types of the genus.

[68] The Academy Collection includes a male from Ceará-Mirim, Rio Grande do Norte, Brazil, and a large previously unrecorded series from Ciudad Bolivar, Venezuela.

[69] The Academy Collection includes a paratype from Chapada, Brazil, and two previously unrecorded females from the Rio Caura, Venezuela.

In size and form the resemblance to the normal type of *S. cyanipes* (Fabricius) is decided, but the much longer ventro-internal spur of the caudal tibiae, the proportionately broader frontal costa and the very different coloration of the caudal limbs readily distinguish *alticola*.

Type.—♂; Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, Colombia. Elevation, 6500 feet. April 25, 1914. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 459.]

Size small, form slender for the genus. Head with fastigium blunt, slightly longer than wide, the dorsal impression greatest at its crescentic base, lateral carinae rounded angulate at dorsal apices of eyes. Lateral foveolae rounded rectangulate, showing few impressed punctae, margins decidedly rounded (foveolae more impressed with margins more sharply rounded in *pratensis*). Frontal costa broad, showing an extremely feeble narrowing above the antennae and very feebly convex with few impressed punctae except near median ocellus, from which point for a brief distance ventrad it is broadly and shallowly sulcate. Eyes slightly projecting, this slightly greater than in *pratensis*. Pronotum similar but proportionately slightly shorter than in *pratensis* or *smithi*; lateral carinae distinct cephalad and caudad and strongly convergent so that the disk is strongly constricted mesad, the lateral carinae there obsolete; median carina distinct, cut very little cephalad of the middle (caudal portion proportionately slightly less elongate than in *pratensis* or *smithi*); caudal margin of disk obtuse-angulate; lateral lobes deep. Interspace between mesosternal lobes subquadrate. Tegmina elongate, extending well beyond apices of caudal femora; costal dilation slight, apex rotundato-truncate. Caudal femora elongate. Caudal tibiae with external spines (eight to eleven in series); ventro-internal spur elongate and slender, slightly over twice as long as dorso-internal spur,[70] its apex unspecialized.

Allotype.—♀; same data as type. [Hebard Collection.]

Size larger, form slender, very slightly more robust than male. Head with fastigium slightly blunter, the dorsal impression appreciably wider than long. Interspace between mesosternal lobes subquadrate.[71] Tegmina elongate, extending decidedly beyond apices of caudal femora.[72]

[70] In the series the length of this spur varies to twice the length of the dorso-internal spur.

[71] A slight amount of variation in this feature is shown by the series.

[72] The series shows some variation in the tegminal length, the females having the tegmina averaging more elongate than the males.

Though exhibiting great variation in detail, this insect shows no exceptional individual color differentiation for a species of *Scyllina*. Material from other localities would probably show a much wider range of shade, maculation, and intensification and recession of color pattern, though the color pattern itself might be constant.

The Taquina series is very dark, blackish brown in general coloration, the head showing a broad post-ocular dark band and frequently with frontal costa darkened and also with a broad sub-ocular dark band. In a few specimens a medio-dorsal pale band, buffy, yellowish or green, occurs on head and pronotum, this weaker but continued on the tegmina. The pronotum has the lateral carinae feebly outlined in buffy, the lateral lobes with a broad, irregular, oblique blackish marking, above which is a pale irregular, oblique marking extending to the relatively pale genae. The tegmina have a series of irregular pale maculations on the lateral field, these greatly reduced in the darkest specimens. The caudal femora have their dorsal and external faces pale, cinnamon-buff, with a proximal black blotch, a broad, oblique median black bar extending to near the ventral portion, an adjacent elongate black suffusion to near the genicular areas which are also black; their ventral surface is brilliant garnet brown, becoming black immediately before a buffy pregenicular cinnamon suffusion. The caudal tibiae are briefly buff proximad, shading rapidly to rich garnet brown.

The San Miguel series averages considerably paler, several of the palest examples having the caudal femoral dark markings greatly reduced, with ventral surface proximad carmine, shading through ox-blood red to black before the pregenicular pale area. Two specimens are generally rather suffused and speckled, with ventro-external carina of caudal femora heavily beaded with black.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotum	Length of tegmen	Length of caudal femur	Width of caudal femur
Taquina, *type*	22	4.2	3.1	21.8	15.7	3.4
Taquina, *paratype*	21	3.8	2.8	20.2	14.4	3.2
Taquina, *paratype*	24	4.4	3.3	22.7	16.4	3.7
San Miguel	24.5	4.4	3.2	22.3	16.2	3.5
♀						
Taquina, *allotype*	31	5.2	3.9	28.8	18.9	4.3
Taquina, *paratype*	29	5	3.8	26.8	19	4.3
Taquina, *paratype*	31.2	5.6	4.2	28.7	19.2	4.7
San Miguel	26.5	5.1	3.8	27	18.2	4.1

Specimens Examined: 21; 10 males, 11 females.

Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, 6500 feet, IV, 25, 1914, (M. A. Carriker, Jr.), 9 ♂, 6 ♀, *type, allotype, paratypes.*

Macotama Valley above San Miguel, Sierra Nevada de Santa Marta, Magdalena 7000 to 8000 feet, IV, 3, 1914, (M. A. Carriker, Jr.), 1 ♂, 5 ♀.

OEDIPODINAE

Group *Lactistae*

Lactista pulchripennis Saussure

1884. *L[actista] pulchripennis* Saussure, Prodr. Oedipodiorum, p. 143. [♂; Colombia.]

1913. *Lactista australis* Bruner, Ann. Carnegie Mus., VIII, p. 457. [♂, ♀, Bonda, seven miles east of Santa Marta, [Magdalena], Colombia.]

There is no justification for the description of *australis* by Bruner. The "decidedly smaller" feature, alone given as differential, is a matter of three millimeters difference in body length, his insect having the tegmina one millimeter shorter than Saussure's type.[73] Bruner's description of *australis* indicates no other differentiation.

Bonda, Magdalena, VII, 15, 1902, (H. N. Howland), 1 ♂.

Mamatoco, Santa Marta, Magdalena, XII, 1917, (M. A. Carriker, Jr.), 1 ♂, 1 ♀.

Santa Marta, Magdalena, X, 1917, (M. A. Carriker, Jr.), 1 ♀.

Las Mesitas, Cundinamarca, V, 1918, (from A. Maria), 1 ♂, 4 ♀.

Sasaima, Cundinamarca, IV, 1905, (from A. Maria), 1 ♀.

The present series shows the following extremes; length of body, ♂, 15.7 to 17.2; ♀, 21.1 to 23.7: length of tegmen, ♂, 18.5 to 19; ♂, 22.3 to 25.8 mm.

Group *Pauliniae*

Paulinia acuminata (DeGeer)

1773. *Acrydium acuminatum* DeGeer, Mém. l'Hist. Ins., III, p. 501, pl. 42, fig. 10. [Surinam.]

[73] There is in the author's collection a hitherto unreported series of six males and ten females from San José and Monte Redondo, Costa Rica. The length of the males is, 16.7 to 18.7, of the females, 21.3 to 25.4 mm., a usual degree of variation for this group. The tegminal length, as would be expected, shows variation exceeding that used as of diagnostic value by Bruner; males, 18.4 to 21.4; females, 24 to 26.6 mm.

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 12 ♂, 28 ♀.

A few of the females, but none of the males, of the present series, are almost entirely green. As is usual, several distinctive chromatomorphs are present.

It is possible that this remarkable genus and species of grasshopper will require the erection of a subfamily name for its reception.

Ommexecha apolinari new species (Plate X, figure 4.)

This beautiful species has the pronotum less tuberculate and less sellate, with oblique lateral ridges less decided, than in any other species of the genus.

The genicular projections of the caudal femora are very short and blunt, slightly shorter than in *O. giglio-tosi* Bolivar,[74] with which species it agrees, except in the features mentioned above, and in the wing coloration.

Type.—♂; Cordillera de la Quinta, Cundinamarca, Colombia. December, 1916. (From A. Maria.) [Hebard Collection, Type no. 460.]

Size as great as the maximum known for the genus; form rather robust, but slender for the genus. Head tuberculate, with protuberant eyes, broad and concave vertex and specialized fastigium as characteristic of the genus. Pronotum subsellate, tuberculate, with oblique ridges from near ventro-cephalic angle of lateral lobes to dorsal-caudal angle of same very weakly defined, caudal margin of disk with lateral portions very feebly convex and forming an angle of slightly over ninety degrees, supplied with seven decided tubercles; ventro-caudal angle of lateral lobes with a moderate tubercle (not projecting conspicuously laterad when viewed from above, as in *O. brunneri* Bolivar and *giglio-tosi*). Tegmina elongate, extending far beyond apex of abdomen, the costal margin rounding rather sharply distad to the acute apex at the sutural margin. Wings with veins and veinlets not darkened in disk except toward the peripheral margin. Limbs generally as characteristic of the genus. Caudal femora with projections from apices of genicular arches very weakly and bluntly produced.[75] Caudal tarsi with last joint equal to combined length of metatarsus and second joint.

[74] The Philadelphia collections include material of this species from Caiza, Ecuador, and from the provinces of Salta and Jujuy, Argentina.

[75] In all the described species of the genus these arches are more projecting, except in *O. germari* (Burmeister), in which they do not project at all.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Very similar to male. Size larger, tubercles slightly weaker, caudal margin of pronotum with angle very bluntly rounded.

Entire insect fuscous (*paratypes*), natal brown (*type*) or walnut brown (*allotype*), except eyes and antennae which are darker, while in two examples traces of two darker, transverse, dorsal bands are found on the caudal femora. Wings transparent, hyaline tinged with pale dull green-yellow, the veins and veinlets dark brown in distal portions. Internal face of caudal femora brilliant begonia rose proximad, followed by a less extensive area of shining black, elsewhere of the general coloration. In a recessive example these most striking, but normally concealed, markings are less brilliant.

The measurements of the type and allotype are given first for their respective sexes. Length of body, ♂, 19 and 21.3; ♀, 26 and 28: length of pronotum, ♂, 4.7 and 4.7; ♀, 5.8 and 5.7: caudal width of pronotum, ♂, 3.8 and 3.8; ♀, 4.7 and 4.7: length of tegmen, ♂, 22.7 and 21.8; ♀, 28 and 27: median width of tegmen, ♂, 3.3 and 3.2; ♀, 4 and 4.1: length of caudal femur, ♂, 10.9 and 10.8; ♀, 13.2 and 12.8 mm.

In addition to the type and allotype, a paratypic pair from Susumuco, Cundinamarca, taken December, 1916, from A. Maria, have been examined.

CYRTACANTHACRINAE

Group *Diedronoti*

Agriacris tricristata (Serville)

1839. *Xiphicera tricristata* Serville, Hist. Nat. Ins., Orth., p. 613. [♀, Colombia.]

1839. *Xiphicera octolunata* Serville, Hist. Nat. Ins., Orth., p. 615. [♂, Colombia.]

(Not *Xiphicera caternaultii* Feisthamel, as confused by various authors.[76])

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 1 ♂.

This beautiful insect belongs to a division of the present genus in which the species have the transverse sulci of the pronotum decided, the pronotal surface coarsely roughened, the median carina decided and tuberculate, the lateral carinae less strongly so.

[76] See Carl, Rev. Suisse Zool., XXIV, p. 503, (1916).

The species of *Agriacris* (*Elaeochlora* of authors) have so strikingly pronounced differences in structure that one might easily believe several generic units to be included. Close examination, however, shows that many more less evident, though apparently more fundamental, characters have a uniformity which, in large measure, appears to indicate that but a single genus should be recognized. We, therefore, do not recognize *Camposia* Bolivar, described in 1909, as a valid genus.

A Panamanian series of this species at hand convinces us of the above[77] synonymy. We regret that the description of the less readily recognizable female has priority over that of the more distinctive male.

Comparison of the female sex of *tricristata* with that of the other species here recorded, shows it to differ in being slightly more robust, the head and pronotum usually (but not always) without a medio-longitudinal band, the median and lateral carinae of the pronotum more decided, with tuberculations larger and more conspicuous than elsewhere and tegmina broader proximad but tapering more sharply distad (in the Panamanian series extending to near apex of abdomen, sometimes distinctly shorter). The longest (medio-internal) spine of the dorsal margins of the caudal tibiae ranges from 3.8 to 4.3 mm. in length, this being given as three lines by Serville and constituting the only noteworthy difference from the original description in the material before us.

Agriacris bivittata (Gerstaecker)

1873. *Xiphocera bivittata* Gerstaecker, Ent. Zeit. Stettin, XXXIV, p. 187. [♂; Bogotá,[78] Colombia.]

Susumuco, Cundinamarca, X, 10, 1917, (from A. Maria), 2 ♂.

Villavicencio, Intendencia del Meta, VI, VII, IX and X, 1917, 1918 and 1919, (from A. Maria), 7 ♂, 5 ♀; XII, 1918, (from A. Maria) 2 juv. ♂.

[77] This was first indicated by Pictet and Saussure, who, however, at that time had confused *Aeolacris caternaultii* (Feisthamel) with the present species. Mitth. Schweizer Ent. Ges., VII, p. 340, (1887).

[78] This specimen undoubtedly came, not from Bogotá, but from the adjacent tropical regions and very possibly from near the localities here recorded. It was customary for the commercial collectors of that period to label all such material "Bogotá."

Length of body, ♂, 31.2 to 36.5; ♀, 45.5 to 52: length of pronotum, ♂, 7.7 to 9.7; ♀, 19 to 20.8: caudal width of pronotal disk, ♂, 4.2 to 4.8: ♀, 9 to 9.3: length of tegmen, ♂, 25.5 to 27.3; ♀, 30 to 35: greatest tegminal width, ♂, 5.2 to 5.7; ♀, 8.8 to 9.8: length of caudal femur, ♂, 18.8 to 20.7; ♀, 28 to 30.5 mm.

Agriacris plagiata (Walker)

1870. *Xiphocera plagiata* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 524. [♂; Bogotá,[79] Colombia.]

1873. *Xiphocera picticollis* Gerstaecker, Ent. Zeit. Stettin, XXXIV, p. 188. [♂; Bogotá,[80] Colombia.]

Comparison of the original descriptions with the material before us convinces us of the synonymy indicated above.

Muzo, Boyacá, IX, 1919, (from A. Maria), 2 ♂, 1 ♀, 1 juv. ♂.

The large immature male shows plainly the distinctive head and pronotal markings, characteristic of this sex of the species. The present specimens are probably in a better state of preservation than the type. In these males the distinctive markings of the head and pronotum are warm buff, excepting the medio-longitudinal dorsal stripe which is parrot green.

Length of body, ♂, 28.8 to 30.8; length of pronotum, 9.3 and 9.3; caudal width of pronotal disk, 4.3 and 4.3; length of tegmen, 18.7 and 19.6; greatest tegminal width, 4.6 and 4.7; length of caudal femur, 18.4 and 19 mm.

We have before us a female from Villavicencio, Intendencia del Meta, taken in August, from A. Maria, which undoubtedly represents still another species. This we do not feel justified in describing without the male, which sex, in all of the allied species, shows much greater specific difference than do the females.

Agriacris brunnea new species (Plate XIII, figure 5.)

This insect is distinctive in coloration, the male being uniform brown, with wings buffy and veins darkened disto-cephalad; the female similar except that the tubercles of the caudal margin of the pronotum and the anal field of the tegmina are buffy. De-

[79] See footnote 78.

[80] See footnote 78.

cided reduction in the organs of flight is shown by the male, these appendages being even more reduced in the female.

In general form the male is much as in *A. plagiata* (Walker), differing in the slightly smoother dorsal surface of the head and slightly rougher face, more slender antennae, blunter vertex, pronotum with medio-longitudinal carina weaker but with prozonal portion more convex, and much more decidedly reduced tegmina and wings.

Infromation requested from Uvarov, at the British Museum, convinces us that either the genus *Elaeochlora* falls as a synonym of *Agriacris*[81], or at least that all of the Colombian species now assigned to *Elaeochlora* have to be transferred to *Agriacris*, of which *Camposia* Bolivar, described in 1909, is probably a synonym. Uvarov also states that *A. ferox* Walker is a synonym of *A. plagiata* (Walker).

Type.—♂; Las Mesitas, Cordillera de Bogotá, Cundinamarca, Colombia. May, 1918. (From A. Maria.) [Hebard Collection, Type no. 882.]

Size small, form average for the genus. Head with occiput feebly impresso-punctulate, face more strongly so. Vertex with dorsal surface of fastigium sloping from a medio-longitudinal linear sulcation to the straight, convergent lateral margins with apex blunt; fastigium slightly longer than basal width. Frontal costa sulcate to apex of fastigium, in lateral aspect evenly oblique with plane of face. Antennae slightly longer than caudal femora, slightly flattened proximad. Pronotum scabrous, the lateral carinae distinct caudad, running ventro-cephalad across cephalic portion of lateral lobes, median carina weak but distinct, prozonal portion of disk convex, cephalic margin with a minute angulate emargination mesad, caudal margin of disk sharply angulate produced at slightly less than ninety degrees. Tegmina reduced, elongate oval, extending to base of supra-anal plate, apices rather broadly rounded. Wings shorter than tegmina, much reduced but with venation still distinct. Carinae of caudal femora with minute tuberculations. Caudal tibiae with dorso-internal spines considerably longer than the dorso-external (longest 1.8 mm.).

Allotype.—♀; same data as type. [Hebard Collection.]

Much larger and more robust than male, as is usual in the genus, also differing as follows. Vertex with dorsal surface of fastigium deplanate with apex rounded, fastigium distinctly shorter than basal width. Antennae decidedly shorter than caudal femora. Caudal margin of pronotal disk supplied with

[81] Cat. Dermapt. Saltat. British Mus., IV, p. 644, (1870).

large tubercles, produced at distinctly less than ninety degrees. Tegmina decidedly reduced, extending less than half the distance to apex of abdomen, costal margin straight to before median portion, then broadly convex, thence straight and oblique to the broadly rounded apex. Wings greatly reduced, vestigial. Longest dorso-internal spine of caudal tibiae, 3 mm. in length.

Male uniform dark mummy brown shading to prout's brown on limbs and abdomen. Antennae becoming mars brown distad. Caudal tibiae tinged with purplish. Wings transparent buffy, veins of anterior field, except proximad, and distad in radiate field tinged with brown.

Female dark brown, more olivaceous, and in part discolored. Pronotum with tubercles of caudal margin buffy. Tegmina uniform sepia, the anal field light buff with anal vein black. Caudal tibiae brown.

Length of body, ♂, 28.2; ♀, 55.5: length of pronotum, ♂, 9; ♀, 19: caudal width of pronotal disk, ♂, 4.3; ♀, 8.6: length of tegmen, ♂, 13.2; ♀, 16.3: width of tegmen, ♂, 4.9; ♀, 8.8: length of caudal femur, ♂, 17.7; ♀, 27.6 mm.

This interesting species is known only from the described pair.

Diedronotus rosulentus (Stål).

1878. *T[ropidonotus] rosulentus* Stål, Bih. K. Svenska Vet.-Akad. Handl., v, no. 9, p. 19. [♂, ♀; Colombia.]

Bonda, Magdalena, VII, 15, 1902, (H. W. Howland), 1 ♀.

Mamatoco, Magdalena, XII, 1917, (M. A. Carriker, Jr.), 1 ♂.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 2 ♂.

Honda, Tolima, III, 1913, (from A. Maria), 1 ♂, 2 ♀.

Las Mesitas, Cordillera de Bogotá, Cundinamarca, V, 1918, (from A. Maria), 1 ♂.

Jiminez, Cordillera Occidental, El Valle, V, 1907, (M. G. Palmer), 1 ♂, [A. N. S. P.].

The female from Jiminez is unusually large: length of body, 55; length of pronotum, 19.8; length of tegmen, 49.2; length of caudal femur, 30.3 mm.

Draconata mancus Pictet and Saussure (Plate XIII, figure 6.)

1887. *D[raconata] mancus* Pictet and Saussure, Mitth. Schweizer Ent. Ges., VII, p. 342. [♂, Colombia.]

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 2 ♂, 5 ♀, 1 juv. ♂, 3 juv. ♀.

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 1 ♂, 1 juv. ♂, 2 juv. ♀.

The previously undescribed female differs from the male of this very distinctive grasshopper only in the larger size, more uniform brown coloration, broader vertex, the triangular sections of the pronotal carinae proportionately slightly less acute, the tegmina separated by a wider interval and with a paler stripe near the sutural margin only.

Length of body, ♂, 31.8 to 32.5; ♀, 50.7 to 56.6: length of pronotum, ♂, 10.7 to 10.3; ♀, 14.1 to 15: greatest pronotal width,[82] ♂, 6.4 to 6.2; ♀, 8.5 to 8.7: length of tegmen, ♂, 6.8 to 7.2; ♀, 10.9 to 11: greatest tegminal width, ♂, 3.8 to 4; ♀, 6 to 6.2: length of caudal femur, ♂, 18.3 to 18.5; ♀, 25.4 to 27.7 mm.

Colpolopha simplex new species (Plate XIII, figure 7.)

This species agrees with *C. biloba* Pictet and Saussure in having rudimentary organs of flight. Compared with a Peruvian female of that species in the author's collection, that insect is found to differ strikingly in the decidedly more produced fastigium, decidedly more concave face in lateral aspect, generally less rounded contour of pronotum and immaculate tegmina, with ventral portion very much more lobate and truncate dorsal portion narrower, so that the distal concavity is much stronger.[83]

The present species is nearest *C. bruneri* Rehn, of which the types and a Costa Rican series are in the Philadelphia collections, that insect differing in the longer narrower fastigium, more concave face in lateral aspect, more decided pronotal crest with heavier emarginato-serrate caudal portion, less reduced tegmina and wings, less distinctively marked tegmina, generally rougher surface and much more angular contour.

Type.— ♀; Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. Elevation, 4000 to 5000 feet. July 10, 1913. (M. A. Carriker, Jr.) [Hebard Collection, Type no 461.]

Size small for genus, form rather robust. Surface rather smooth, the pronotal surface with only scattered microscopic tuberculations. Fastigium very short for genus, length equal to width, surface deplanate with a subobsolete medio-longitudinal

[82] Between points of first lateral projections on metazona.

[83] The vestigial wings appear to be buffy, but discoloration may have occurred.

sulcus, lateral margins cingulate, weakly convex-convergent to apex. Frontal costa very narrow and moderately sulcate to near its dorsal extremity, where it decreases only slightly in width,[84] expanding below the median ocellus, its lateral margins weakly carinate to the clypeal suture;[85] facial carinae weak but distinct. Eye slightly longer than infra-ocular sulcus. Antennae depressed, very feebly ensiform. Pronotum with prozona and metazona of subequal length; median crest rising evenly and moderately from cephalic margin to near caudal extremity where, from the convex summit, it descends rapidly to the caudal apex and is there bluntly serrate (showing from four to five serrations), this section is scarcely defined, not showing the abrupt differentiation usual in the species of the genus; transverse sulci distinct but scarcely cutting crest; cephalic margin of disk produced over occiput in an acute but brief projection; lateral marginal carinae of disk distinct, roughened but not tuberculate. Prosternal spine moderately elongate, erect, blunt. Tegmina rudimentary, less than half as long as the short caudal femora, overlapping dorsad; costal margin strongly lobate, the distal portion briefly produced and transversely truncate, the lobe of the costal margin larger than that formed by the distal portion of the tegmen. Wings rudimentary, no longer than broad, appreciably shorter than tegmina; remaining veins distinct. Caudal femora very short and heavy for genus, dorsal surface supplied with minute subdenticulations, which are heavier but distantly placed on the carinae. Caudal tibiae with dorso-internal spines decidedly longer than dorso-external spines and feebly curved.[86]

General coloration bone brown, shading to roods brown or clay color ventrad. Face sometimes showing flecks of clay color. Dorsum of pronotum darkest; lateral lobes paler, flecked or mottled with cinnamon, except in one specimen (recessive) where they are mottled with clay color as are the other lateral portions. Tegmina warm sepia with a large, irregularly rounded spot of orange-cinnamon or vinaceous-cinnamon latero-proximad and a similar smaller marking distad in marginal field, while the distal portion of the dorsal field is likewise pale. Wings light coral red, suffused distad in anterior field with blackish brown. Caudal femora with outer faces rather pale, the dorsal surface darkest; the carinae of the

[84] In this respect agreeing with *bruneri*. In *C. sinuata* Stål it is lamellate-cultriform very briefly at dorsal extremity. In *C. latipennis* Stål and *C. metae*, here described, it is lamellate-cultriform to between the antennae.

[85] Decidedly weaker in this portion than is usual in the genus.

[86] Much as in *bruneri* and *obsoleta*, in *latipennis* and *sinuata* the dorso-internal spines are heavier and longer.

dorsal and ventral surfaces with flecks of blackish brown, these occupying the serrulations dorsad. Caudal tibiae sepia or saccardos umber, internal spines almost entirely black, external spines black tipped.

The distinctively maculate tegmina and beautifully colored, though rudimentary, wings afford the most striking and distinctive features of coloration.

The measurements of the type are given first, followed by those of the three paratypic females. Length of body, 32.4 30 to 33.7; length of pronotum, 12, 12.2 to 13.8; width of pronotum, 6, 5.8 to 6.7; length of tegmen, 8.7, 8 to 10; length of caudal femur, 20.2, 19.7 to 20.7 mm. The height of the pronotal crest is 3.3 to 4.1; width of caudal femur, 4.8 to 5.4 mm. A slight degree of variation of the serration of the pronotal crest caudad is apparent.

In addition to the type, three paratypic females bearing the same data are before us.

Colpolopha rehni new name

1901. *Colpolopha sinuata* Bruner (not of Stål, 1873), Biol. Cent.-Amer. Orth., II, pl. II, figs. 25 and 25a. [♀, [Central America].]

1907. *Colpolopha latipennis*? Bruner (not of Stål, 1873), Biol. Cent.-Amer., Orth., II, p. 228. [♀, Central America.]

1913. *Colpolpha latipennis* Bruner (not of Stål, 1873), Ann. Carnegie Mus. VIII, p. 461. [♀; Bogotá,[87] Colombia.]

The material upon which the above records were based is before us, as well as an additional female from Carrillo, Costa Rica.[88] This insect is clearly distinct from, though closely allied to, *C. sinuata* Stål. It differs from that species in the smaller size and less acute form; the pronotum with median crest weakly convex in metazonal portion (and in consequence not as strongly ascendant caudad), with emargination caudad proportionately shorter and much less heavily dentate; the organs of flight shorter, not reaching apex of abdomen, the tegmina with distal truncation concave and less strongly oblique, so that the apex at the costal margin is consequently shorter.

In both species the coloration is dark brown, the tegmina showing several large, irregular, paler maculations. The wings are

[87] In the early days material was often labelled "Bogotá" which had been taken in Colombia at considerable distances from that city. The present is almost certainly another case of such incorrect labelling.

[88] This specimen is here selected as type of *rehni*, Hebard Collection, Type no. 883.

coral pink,[89] except the apex of the radiate and all of the anterior field, which areas are strongly suffused with brown. Likewise in both species the disk of the pronotum sometimes bears a few large, irregular, black nodes laterad; sometimes these are subobsolete.

Bruner's figures of this species, referred to above, at that time determined as *sinuata*, are excellent, except that the spines of the caudal femora are much more slender, the antennae considerably more ensiform and the vertex has its lateral margins less convergent to near the apex, where they are strongly convex-convergent.

Measurements (in millimeters)

♀	Length of body	Length of pronotum	Length of metazona	Length of tegmen	Length of caudal femur
Carrillo, Costa Rica, *type*....	54	24.1	14	32.2	29.5
"Central America," *paratypes*	50.8	22.2	13.2	29	25.8
"Bogotá," Colombia.....	55.2	22.2	13.2	31	29.6

The height of the longest tooth caudad on the emargination of the pronotal crest individually varies from .7 to .9 mm. in the specimens before us.

The three examples of the species known to us bear no further data than that given above.

We take great pleasure in naming this species in honor of our friend and fellow-worker, Mr. James A. G. Rehn, whose studies have done so much toward placing the knowledge of Costa Rican Orthoptera on a sound basis.

Colpolopha sinuata (Stål)

1873. *Colpolopha sinuata* Stål, Ofv. Kongl. Vetensk. Akad. Forhandl., xxx, no. 4, p. 53. [♂; Remedios, [Antioquia], Colombia.]

Stål's original description is virtually useless, but he later described the type at greater length.[90]

Intendencia del Chocó, (M. G. Palmer), 1 ♀, [A. N. S. P.].

Three hundred miles up Rio Atrato, Intendencia del Chocó, 1 ♂, 1 ♀, [A. N. S. P.].

Córdoba, El Valle, IV, 23, 1918, (M. A. Carriker, Jr.), 1 ♂.

[89] In much discolored specimens faded to buffy brown.

[90] Recens. Orth., I, p. 45, (1873).

As described by Stål, the lateral carinae of the frontal costa (as well as those margining the fastigium) are obtusely (and irregularly) subcrenulate.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of metazona	Length of tegmen	Length of caudal femur
♂					
Córdoba, El Valle.....	45	21	12.9	30	26
Rio Atrato, Chocó.....	44.7	22.1	13.8	32.8	26.2
♀					
Rio Atrato, Chocó.....	60	28.3	17.6	42.2	34.1
Intendencia del Chocó.....	60.5	28.2	17.3	42.8	34.2

The height of the longest tooth caudad on the emargination of the pronotal crest individually varies as follows; ♂, 1.2 to 1.4; ♀, 1.9 and 1.9 mm.

This large species is one of the handsomest of the genus.

Colpolopha metae new species (Plate XIII, figures 8 and 9.)

This species may be distinguished by the heavily but irregularly tuberculate lateral margins of the pronotal disk and the reduced tegmina, which are slightly longer than the pronotum, with convexity of coastal margin decided and apex truncate, showing scarcely any obliquity.

The insect is not closely related to any of the previously known forms, but is apparently nearest *C. sinuata* Stål. From that species it differs in the even more slender form, the very much lower pronotal crest with emargination caudad very much weaker and feebly and bluntly subdenticulate, the greatly reduced organs of flight and other less conspicuous features.

The vertex is, however, more as in *C. latipennis* Stål, of the described forms.

The bluntly denticulate lateral margins of the pronotal disk show a tendency in this insect toward the remarkable specialization found in the genus *Helionotus*.

Type.— ♀ ; Villavicencio, Intendencia del Meta, Colombia. February, 1919. (From A. Maria.) [Hebard Collection, Type no. 884.]

Size medium and form rather slender for the genus. Fastigium elongate, over twice as long as median width, dorsal surface concave between the lateral carinate margins, which are weakly convergent, then parallel and distad rounded to the

angle which they form at the frontal costa; the latter lamellate cultriform to between antennae; in lateral aspect the fastigium projects strongly, so that broad obtuse-angulate emargination of the face is shown with apex at median ocellus. Below that point the frontal costa expands, its lateral margins strongly carinate and subtuberculate to the clypeal suture; accessory facial carinae indicated by rows of tubercles. Genae, face and lateral lobes of pronotum well supplied with minute but sharp tubercles. Eye slightly longer than infra-ocular sulcus. Pronotum with metazona distinctly longer than prozona; median crest weak, rising evenly caudad to near caudal extremity, where for a brief distance it is concave and very feebly and bluntly denticulate. Crest strongly cut by transverse sulci as in *sinuata*, with prozonal portion bluntly tuberculate. Lateral carinae of margins of pronotal disk cut by the three transverse sulci, deeply by the principal of these; strongly defined in a series of large, blunt tubercles which are decidedly irregular caudad, the last of these conspicuously projecting at base of caudal margin: caudal margin with lateral portions smooth, converging evenly and showing faint concavity to the acute apex. Surface of pronotal disk with a few blunt denticulations, prozonal portion weakly tuberculate, metazonal portion thickly and finely impresso-punctulate, cephalic margin acutely produced over occiput. Prosternal spine erect, elongate-conical, acute. Tegmina decidedly reduced but more than half as long as the elongate caudal femora; costal margin with a large lobe, proximo-mesad in position, occupying fully half of this margin; distal portion with margins very feebly convergent, almost parallel, to the truncate and very feebly oblique apex, the angles there broadly rounded.[91] Wings greatly reduced, width slightly more than half length, truncate distad, with remaining portions of veins distinct. Subgenital plate even more elongate produced than in *sinuata*, free margins not straight as in that species, but showing weak convexity distad toward the acute apex. Caudal femora elongate, carinae minutely denticulate. Caudal tibiae with the heavier dorso-internal spines longer than in *C. simplex* here described, shorter than in *latipennis*.

Allotype.—♂; same data as type. [Hebard Collection.]

Differs from female as follows. Size much smaller, form more slender and more angular. Fastigium with lateral margins more nearly parallel to near apex, length twice median width. Eye nearly a third longer than infra-ocular sulcus. Pronotum more angular, with tuberculations, particularly of the carinate lateral margins of the disk, more pronounced.

[91] In the type alone a trace of falcation at the costal angle of one tegmen is indicated.

General coloration dark brown, sometimes weakly mottled. Tegmina sometimes showing two or three large irregular patches of paler brown. Wings (apparently discolored) weakly tinged with buffy brown, the veins brown. Caudal femora with internal portion of ventral surface blackish but showing a reddish tinge, external portion blackish internally, with spots of this color invading its external section which is of the paler general coloration. Male with ventral surface buffy brown flecked with blackish brown, a patch of the latter mesad on the four last tergites. The series before us is so discolored that we believe more detailed color description undesirable.

For the females, the measurements of the type are given first, followed by the extremes in the three paratypes. Length of body, ♂, 35.8; ♀, 53.2, 52[92]: length of pronotum, ♂, 11.7; ♀, 17.1, 15.5 to 17: length of pronotal metazona, ♂, 6.2; ♀, 10, 8.7 to 9.8: width of pronotum, ♂, 6.5; ♀, 9.4, 8.9 to 9.1: height of pronotal crest, ♂, 3.4; ♀, 5.4, 5.3 to 5.6: length of tegmen, ♂, 12; ♀, 16.7, 17.2 to 19.6: length of caudal femur, ♂, 20.2; ♀, 28, 26.2 to 29.2: width of caudal femur, ♂, 3.8; ♀, 4.9, 4.8 to 5.3 mm.

In addition to the type and allotype, three paratypic females are before us, all bearing the same data, except that one was taken October 10, 1917.

Group *Chromacres*

Chromacris psittacus (Gerstaecker)

1873. *Romalea psittacus* Gerstaecker, Ent. Zeit. Stettin, XXXIV, p. 185. [♂, ♀; Bogotá,[93] [Colombia].]

Andagoya, Antioquia (Chocó), IV, 22, 1918, (M. A. Carriker, Jr.), 1 ♀.

Chochó, El Valle, (M. G. Palmer), 1 ♀, [A. N. S. P.].

Jiminez, El Valle, III, 1907, (M. G. Palmer), 4 ♂, 1 ♀, [A. N. S. P.].

Las Mesitas, Cundinamarca, IX, 1915, (from A. Maria), 1 ♂, 3 ♀.

These specimens are in every way typical. Variation in some of the distinctive markings is wholly attributable to variation within the species, this apparently due to differences in local environmental conditions.

[92] This appears to be about the normal average. All of the females have the abdomen much distorted.

[93] As noted for other early material so labelled, the types undoubtedly came from the tropical regions some distance from the city of Bogotá.

We would note that the femora and tibiae of the cephalic and median limbs each have a single annulus; the caudal femora three annuli, of which the proximal is broad or is interrupted mesad; the caudal tibiae two annuli. The pronotum, in addition to the two dorso-lateral maculae of the prozona and ventral marginal bands of the lateral lobes, are found to have two minute latero-caudal marks on the metazona present or absent, and a minute marking on the lateral lobes at the humeral sinus subobsolete to decided. The wings are salmon-orange or cadmium-orange marked with black. The distal orange area is occasionally decidedly reduced, as shown by a female in which this area is not continued caudad of the anterior field.

The specimen queried as this species by Bruner in the Biologia, from Siquirres, Costa Rica, shows no differences worthy of separation. The lateral lobes are not maculate at the humeral sinus and the wings are apricot yellow. Such decided difference in wing coloration has been remarked in other species of the genus.

Chromacris icterus (Pictet and Saussure)

1887. *R[omalea] icterus* Pictet and Saussure, Mitth. Schweizer Ent. Ges., VII, p. 353. [♂: Argentina; Plateau of Quito, Ecuador.]

Near Bogotá, Cundinamarca, (from A. Maria), 2 ♂, 5 ♀.

Choachi, Cundinamarca, III, 1916, (from A. Maria), 1 ♀.

Susumuco, Cundinamarca, IX, to II, 1915 to 1917, (from A. Maria), 4 ♂, 2 ♀.

Villavicencio, Intendencia del Meta, V to XII, 1917 and 1918, (from A. Maria), 5 ♂, 3 ♀.

This series is very constant in general coloration. The types are described as having the median femora with a basal spot and a principal annulus of yellow. Two specimens from Gualaquiza, Ecuador, in the Academy Collection, recorded correctly by Giglio-Tos, lack the basal spot, but have the annulus decided, while in the present series a basal spot is absent and the annulus is not continued around the dorsal portion of the limb. The antennae in the males are entirely dark or very briefly pale tipped, in the females briefly to conspicuously pale tipped. Recession, with the consequent obliteration of portions of the normal color pattern, is also found in other species of *Chromacris*.

Group *Tropidacres*

Lophacris olfersii (Burmeister)

1838. *A[cridium] olfersii* Burmeister, Handb. Ent., II, abth. II, pt. I, p. 628. [♂, ♀; Rio de Janeiro, [Brazil].]

Muzo, Boyacá, 1921, (from A. Maria), 1 ♀.

This splendid green insect has the radiate field of the wings largely rich pink with a weak purplish tinge (rich eugenia red in the present specimen), the caudal femora with a band of white spots which often divide proximad. It is the species figured in 1813, by Stoll, as *Gryllus* (*Locusta*) *flavicornis* (not *Gryllus flavicornis* Fabricius, 1787).

Length of body, 80.8; length of pronotum, 19.1; length of tegmen, 78.3; width of tegmen, 19; length of caudal femur, 37.7 mm.

EUTROPIDACRIS new genus

We erect this genus to include the single species described by Linnaeus as *Gryllus* (*Locusta*) *cristata*.[94] This species was subsequently described as *Gryllus carinatus* by Thunberg and again as *Gryllus rugosus* by the same author. It is probable that Stoll's *Gryllus* (*Locusta*) *collaris* represents the same species.

The species had been generally recorded as *cristata* until the appearance of Kirby's catalogue in 1910, where that name was, we believe incorrectly, transferred to a species of the genus *Lophacris*, and the name *Tropidacris collaris* (Stoll) substituted for the species in question. Since that time authors have generally followed Kirby, using the name *collaris* for this insect.

The genus *Eutropidacris* may be distinguished from its nearest ally, *Tropidacris*, by the characters given by Pictet and Saussure to separate *cristata* from the other species referred by them to that genus. Pronotum with prozonal portion smooth, the (three or four[95]) lobes of the strongly elevated crest with lateral dividing sulci very deep; metazonal portion with a very feebly indicated carina, surface impresso-punctate. Wings with

[94] Based on information embracing more than one species, Burmeister in 1838 restricted the name to the South American material. In 1873, Stål examined the Linnaean collections and fixed as type of *cristata* the Brazilian specimen.

[95] The first two lobes sometimes unite to form a single large lobe, but in such cases the dividing sulcus remains as deep laterad as is normal.

dilated median area three times as broad as the very narrow ulnar area.

The genus agrees with *Tropidacris* and differs from *Titanacris* and *Lophacris* in having the wings maculate. It differs from all the known species of *Tropidacris* in having the wings bluish green instead of reddish.

Eutropidacris cristata (Linnaeus)

1758. [*Gryllus* (*Locusta*)] *cristata* Linnaeus, Syst. Nat., Ed. X, I, p. 431. [America, Arabia, Asia.[96]]

Rio Hacha, Goajira Peninsula, Magdalena, XII, 12, 1913, (M. A. Carriker, Jr.), 1 ♂.

This is the most northwestern locality for the species, which apparently does not occur in Central America.

Tropidacris latreillei (Perty)

1830. *Acrydium latreillei* Perty, in Spix and Martius, Delect. Anim. Art., p. 123, pl. XXIV, fig. 4. [Amazon River.]

Near Santa Marta, Magdalena, VI, 1914, (M. A. Carriker, Jr.), 1 ♀.

Salento, Caldas, XI, 11, 1911, (from A. Maria), 1 ♂.

Atuncela, El Valle, VI, 1907, (M. G. Palmer), 1 ♀, [A. N. S. P.].

Jiminez, El Valle, III and V, 1907, (M. G. Palmer), 2 ♀, [A. N. S. P.].

Villavicencio, Intendencia del Meta, (from A. Maria), 1 ♀.

Group *Taeniophorae*

TAENIOPHORA Stål

This genus may be separated from *Ophthalmolampis* Saussure by the less robust build but proportionately larger head, much less strongly and less thickly impresso-punctulate face, caudal femora with genicular projection of meso-dorsal carina acute, caudal femora with other than meso-dorsal carina smooth, cephalic femora of male in some species remarkably specialized and ovipositor normal in being specialized, but with dorsal valves distinctive, in that they are very suddenly and sharply emarginate distad and have the apices consequently very short.

[96] See footnote 94.

Taeniophora chocoensis new species (Plate X, figure 5.)

We regret that the male of this species is unknown, but feel that it can be safely distinguished by the features shown in the probably less distinctive female.

The present insect apparently represents a group distinguished by the dark body with four pale longitudinal bands, green caudal femora with genicular areas yellowish pink and pink caudal tibiae and tarsi.

Type.— ♀ ; Boca Murindó, Intendencia del Chocó, Colombia. February 10, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 886.]

Size rather large, but form normal for the genus, with head very large in proportion to body bulk. Head with interocular space exceedingly narrow; fastigium very small, with a subobsolete linear medio-longitudinal sulcation, weakly declivent and abruptly truncate distad but there rounding smoothly into the frontal costa, which between the antennae is briefly produced, its flattened surface one and one-third times the width of a proximal antennal joint. Head and cephalic portions of pronotum with a few scattered impressed punctae, these heavy ventrad on genae and on the metanotum and pleura. Width of eye one and two-thirds time length of the decided infra-ocular sulcus. Pronotum short, widening moderately caudad, transverse sulci very deep; cephalic margin narrowly embracing occiput and with a distinct though rounded median emargination; caudal margin very broadly convex. Prosternum weakly convex, with a very small, erect, conical projection meso-caudad. Tegmina and wings reduced, covering only proximal two-thirds of abdomen, extending slightly beyond median point on caudal femora. Tegmina with costal and sutural margins evenly and weakly converging to the broadly rounded apex. Wings cycloidal, the free margin moderately scalloped. Ovipositor valves short, as characteristic of the genus. Subgenital plate obtuse-angulate distad, where its dorsal portion is produced in an elongate acute spike, fitting between the ovipositor valves. Cephalic and median limbs unspecialized. Caudal femora robust, with impressed, broadly and bluntly V-shaped sulci of external pagina well defined; carinae smooth except the dorso-median which bears a few feeble serrulations; dorsal and ventro-external surfaces very shallowly impresso-punctate. Caudal tibiae with nine (eight on one tibia in immature example) dorso-external spines (including the distal spine). Caudal tarsus slightly over half as long as caudal tibia (in immature two-thirds as long as caudal tibia); joints elongate, first and second subequal in length, third decidedly longer than second.

Head, pronotum, pleura and tegmina blackish carob brown. Face with a minute fleck on each side of median ocellus, and a larger fleck above clypeal suture on each side, of mustard yellow. Antennae cinnamon, with five terminal joints blackish brown. Head with median portion of fastigium naples yellow, this continued as a very narrow broken line along eyes to base of occiput opposite lateral portions of dorsum of pronotum, there continued as a narrow band, broken by the transverse sulci, and on the tegmina as a percurrent band which narrows and disappears near their apices. Head with a broader band of naples yellow from antennal base along eye across genae, ventral portion of lateral lobes of pronotum and appearing as three dots on pleura, the median of these largest and surrounded by a greenish area. Wings hyaline very faintly tinged with brown, this becoming stronger distad; veins brown. Ventral surface spinach green. Cephalic and median limbs hays russet. Caudal femora spinach green (rich and deep), with genicular areas entirely ferruginous. Caudal tibiae and tarsi coral red.

In an immature individual before us the dorsal surface of the abdomen is brown, becoming yellowish laterad, with a very slender medio-longitudinal line of yellow. This specimen is more brilliant than the type, the yellow markings stronger and brighter (wax yellow), but with face lacking the two ventral flecks.

Length of body, 21.7; length of pronotum, 4.7; length of tegmen, 11; greatest tegminal width, 3.2; length of caudal femur, 12.8; width of caudal femur, 3.4; exposed length of ovipositor, 1.8 mm.

A single immature female is before us in the instar preceding maturity, from M. A. Carriker, Jr., taken at Andagoya, Antioquia (Chocó), on April 22, 1918. We also have a female from Pinogana, Darien, Panama, apparently referable to this species, but having the longitudinal naples yellow bands decidedly broader and percurrent, and the organs of flight slightly shorter.

Taeniophora dagua new species (Plate X, figure 6.)

Closely related to *T. chocoensis*, here described; the present species is likewise known only from the female sex. From that species it is distinguished by the proportionately heavier caudal femora and longer caudal tarsi, the blackish antennae but decidedly paler ground coloration of head, pronotum and tegmina and resultantly less contrasting pale bands, of which the ventrolateral are broader on the genae.

Discovery of the male will probably reveal more striking specific differences.

Type.—♀; Jiminez,[97] El Valle, Colombia. Elevation, 1600 feet. July, 1917. (M. G. Palmer.) [Academy of Natural Sciences, Type no. 5360.]

Agrees with the description of *chocoensis* except as follows. Frontal costa slightly wider between the antennae. Impresso-punctate area below larger pale smooth areas on genae narrower, the face with a few more impressed punctae. Width of eye slightly more than one and two-thirds times length of the decided infra-ocular sulcus. Caudal femora proportionately slightly larger. Caudal tibiae with eight and nine dorso-external spines (including the distal spine). Caudal tarsus two-thirds as long as caudal tibia, second joint slightly longer than first, third decidedly longer than second.

Occiput, postocular portions of genae, pronotum, pleura, abdomen dorsad and tegmina snuff brown. Antennae, except proximal joint, blackish. Fastigium, proximal antennal joint and face cinnamon-buff, deepening to clay color on mouth parts. There are four longitudinal bands, homologous to those of *chocoensis*, of ochraceous-buff, differing from those of that species only in that on the genae they are decidedly broader, leaving only a very narrow border dorsad and a slightly wider area ventrad of the slightly paler general coloration. Ventral surface brown tinged with green.[98] Cephalic and median limbs verona brown. Caudal limbs much as in *chocoensis*. Caudal femora cerro green with genicular areas entirely ferruginous. Caudal tibiae carnelian red, caudal tarsi rufous.[99]

Length of body, 21; length of pronotum, 4.9; length of tegmen, 11.2; greatest tegminal width, 3.3; length of caudal femur, 14; width of caudal femur, 3.8; exposed length of ovipositor, 1.7 mm.

The type is unique.

Ophthalmolampis valida new species (Plate X, figure 7.)

The tegminal reduction found in this insect[100] is only equalled

[97] This locality is situated on the western slope of the Cordillera Occidental.

[98] Some discoloration is evident and this portion may, in life, have been colored as in *chocoensis*.

[99] The evident slight discoloration of the specimen may be due to its having been somewhat teneral when captured.

[100] In locating this species we have been able to determine that, of the eleven forms assigned to *Ophthalmolampis* by Kirby, *trochalus*, *bracteata* and *pulchripes* of Gerstaecker are referable to the genus *Coscineuta*, while *yersini* of Saussure, probably, and *punicea* Gerstaecker, certainly, do not belong to *Ophthalmolampis*.

in the Peruvian *O. cinctipennis* Stål, which species belongs to a distinctive and different group.

Nearest relationship is found to the north Brazilian *O. geniculata* (Stål), from which *valida* may be separated by the tegminal reduction, the paler serrations (rather than tuberculations) and genicular areas of the caudal femora, and the brilliantly colored tibiae and tarsi.

Type.— ♀ ; Susumuco, Cundinamarca, Colombia. Elevation, 2600 feet. (From A. Maria.) [Hebard Collection, Type no. 885.)

Size medium, form robust; smaller than the genotype *O. colibri* Saussure.[101] Head much as in that species, except that the face and genae are more pitted, these large impressed points continued on the frontal costa to near the fastigio-facial angle, with smooth surface of frontal costa narrower, exceeding the width of the proximal antennal joint by a fourth instead of a third. The smooth pale band on the genae is also nearly horizontal, instead of running obliquely to the ventro-caudal angle of the genae, as it does in *colibri*. These species agree in the large eye, the width of which slightly exceeds the length of the infra-ocular sulcus, the very narrow interocular space, the sulcation of the fastigium which is feebly declivent and blunt, transverse distad, rounding evenly into the frontal costa and the impresso-punctate occiput. In the present species the antennae are slender and nearly a third longer than the caudal femora, not as heavy as in *colibri*. Pronotum short, cylindrical, coarsely impresso-punctate, the transverse sulci very deep, particularly laterad; cephalic margin not produced, embracing occiput with a distinct though rounded median angulate-emargination; caudal margin very broadly convex, very much less produced than in *colibri*. Prosternal projection very heavy, convex to the blunt though much more nearly acute apex, which is directed ventro-cephalad. Tegmina represented by oval, dorso-lateral pads, separated by a decided interval. Wings vestigial. Abdomen with dorsal surface showing weakly impressed punctae. Ovipositor valves straight, as characteristic of the genus, but unlike those of *colibri* not completely simplified, having the dorso-external margin of the dorsal valves very feebly subserrulate. Subgenital plate with sides convergent to the apex, where its dorsal portion is produced in an elongate acute spike, fitting between the ovipositor valves. Limbs heavy, the cephalic and median with heavier impressed punctae than in *colibri*. Caudal femora robust, with impressed herring-bone pattern of

[101] A female from Surinam is in the author's collection.

external pagina decided, the six longitudinal carinae serrate, these serrations minute and numerous on the ventro-internal carina, heavy on the others. Caudal tibiae with seven dorso-external spines (including the distal spine). Caudal tarsus approximately three-quarters as long as caudal tibia; joints elongate, the second slightly longer than the first, the third much longer than the second, (in *colibri* the second is proportionately slightly more elongate).

Head with fastigium, face, mouth-parts, sub-ocular portions of genae and antennae saccardos umber, occiput and postocular portions of genae dark olive; interocular space olive-buff, this continued as a narrow line along eyes to base of occiput opposite lateral portions of dorsum of pronotum on each side; a slightly broader line of olive-buff from antennal base along eye across gena, this nearly paralleling ventral margin of gena. Pronotum dark olive, becoming blackish olive laterad, with four lines of rather large olive-buff spots, continuations of the pale cephalic markings, the two dorsal margining the pronotal disk and the metazonal portion of these forming a percurrent line in that area, the two lateral paralleling these and situated near the ventral margin of the lateral lobes. Tegminal pads dark olive becoming blackish olive laterad, with two percurrent longitudinal lines of olive-buff, separated by a space faintly wider than one of these. Other portions of thorax of the pronotal ground color, the pleura with two olive-buff spots on each side, continuing the broken lateral bands. Underparts and abdomen ecru-olive, the latter dark olive in dorso-proximal half, with each segment there showing a narrow dorso-lateral line of ecru-olive on each side, forming two broken narrow pale bands beyond the tips of the tegmina. Cephalic and median limbs blackish carob brown. Caudal femora old gold proximad, shading gradually to serpentine green distad, with serrations of carinae slightly deeper green; genicular areas primuline yellow (bright) in disk, elsewhere chestnut brown except proximo-dorsad where they are ochraceous-tawny. Caudal tibiae oil green in slightly more than proximal-half (except immediate base which is ochraceous-tawny proximad and chestnut brown distad), remaining distal portion and tarsi light jasper red.

A paratypic female before us agrees closely in coloration, except that the caudal femora are bright hazel externally with serrations of carinae slightly darker.

Of these females the measurements of the type are given first. Length of body, 22 and 21.4; length of pronotum, 5.2 and 5.1; exposed length of tegmen, 4.1 and 3.9; greatest tegminal width, 2.2 and 2.2; length of caudal femur, 11.9 and 12; width of caudal femur, 3.4 and 3.4 mm.

A single paratypic female from Hermano A. Maria is before us, taken at Villavicencio, Intendencia del Meta, in December, 1918.

Group *Mezentiae*

The genus *Dicaearchus* runs to this group, due to the presence of a very minute distal spine on the dorso-external margin of the caudal tibiae, the very wide interocular space and the presence of rudimentary tegmina.

The genera assigned to the Mezentiae represent very widely distinct entities, many of which will probably require group recognition, when better understood. Thus one species of *Hisychius* resembles *Ommatolampis*, *Rhicnoderma* resembles *Tarbaleus* and *Dicaearchus* has a puzzling Melanoploid facies. Closer examination, however, shows that no real affinity between any of these apparently analogous genera actually exists.

Hisychius viridiventris new species (Plate X, figure 9.)

This species is readily distinguished from the previously known forms of the genus, as it is bicolored, with a broad pale oblique band on each side of the pronotum.

It apparently represents a distinct group, distinguished by being decidedly more fusiform. As a result the genotype, *H. nigrispinus* Stål,[102] shows a distinctly Rhicnodermoid facies (see plate X, figure 8), while *viridiventris* shows a closer resemblance in form to species of the genus *Ommatolampis*.

Type.—♀; Muzo, Boyacá, Colombia. September, 1919. (From A. Maria.) [Hebard Collection, Type no. 887.]

Robust, fusiform, large, but not as large as *nigrispinus*. Vertex briefly produced and weakly declivent, its lateral carinae coarse and irregular, sulcate, with sulcation continued into the frontal costa, which is distinctly produced to below antennae, there as wide as the interocular space, its surface thickly pitted, as is the face. Face flattened between the lateral carinae, which are distinct only dorsad. Occiput and genae largely smooth but with very feebly impresso-punctulate areas, the genae alone thickly pitted ventrad toward the face. Antennae elongate and slender, as long as caudal femur not including the genicular portion. Pronotum cylindrical, enlarging evenly caudad; surface evenly and strongly rugoso-impresso-punctulate, the rugae

[102] Comparison is made with a female from Yurimaguas, Peru, in the author's collection.

slightly more decided at the caudal margin, which is not tuberculate as in *nigrispinus*; transverse sulci decided but not conspicuous; cephalic margin showing a broad weak median concavity, caudal margin transverse. Other portions of body as pronotum, the impressed punctae becoming finer and weaker distad on abdomen, the mesonotum alone having the caudal margin very faintly more rugose. Prosternum with a heavy, blunt tooth meso-caudad, springing from a heavy base. Tegmina and wings absent. Tympanum large. Ovipositor elongate, the apical portion of the dorsal valves forming a long weakly curved tooth, the ventral valves with apical portion forming a short and strongly curved tooth.[103] Subgenital plate angulate distad. Cephalic and median femora smooth but with dorsal surfaces showing a few irregularities. Caudal femora with carinae, particularly the dorso-internal, denticulate, except the ventro-internal which is smooth. Genicular areas of caudal femora differing from those of *nigrispinus* in being armed meso-dorsad with a minute spine, agreeing in having the dorso-lateral margins minutely serrulate. Caudal tibiae and tarsi supplied with long hairs. Caudal tibiae armed with (seven) dorso-external spines (including the distal spine). Caudal tarsus half as long as caudal tibia not including the thickened basal portion of the latter, second joint half as long as first, third as long as combined length of first and second joints.

Face, dorsal surface of body (except occiput) and dorsal surface of caudal femora, bay. Other portions of limbs and sides of abdomen serpentine green. Antennae vinaceous-rufous proximad, then blackish with last two joints buffy. Eyes brown with a metallic sheen. Occiput mesad and genae buffy, the former with a more nearly buff band margining the eyes and continued to the dorso-lateral portions of the pronotum, this continued across the sides of the pronotum as a broad band of ochraceous-buff, descending obliquely caudad and terminating at the caudal margin above the ventro-caudal angle of the lateral lobes.

Length of body, 35 (estimated); length of pronotum, 6.5; total cephalic width of pronotum, 5.7; total caudal width of pronotum, 7.2; length of caudal femur, 21.4; width of caudal femur, 4.8 mm.

The type of this obscurely, though distinctively, colored grasshopper is unique.

Dicaearchus eumera new species (Plate XIII, figures 10 and 11; plate XIV, figure 1.)

This handsome little species shows many distinctive features of coloration, particularly of the caudal limbs. Though in

[103] In *nigrispinus* the apical tooth of the dorsal valves is as strongly curved as that of the ventral valves.

eumera the frontal costa shows some expansion between the antennae and has the lateral carinae raised above its surface to the median ocellus, the close relationship to the Colombian genotype, *D. cribellatus* Stål, is evident.[104]

Type.—♂; Cali, El Valle, Colombia. Elevation, 3500 feet. February, 1912. (Miller and Allen.) [Hebard Collection, Type no. 902.]

Size small, form much as is normal for the short-winged Melanopli. Interocular space very wide, nearly two and one-half times as wide as the first antennal joint. Fastigium very bluntly triangular, wider than long and nearly horizontal; its surface flattened, showing mere traces of large irregular pits and a subobsolete medio-longitudinal carina. Frontal costa in lateral aspect very feebly convex between antennae and forming a sharply rounded rectangulate fastigio-facial angle; lateral carinae coarse to median ocellus, with intervening space broadly and shallowly concave, below that point subobsolete; width between antennae about three-fifths of interocular space. Face smooth with lateral carinae and infra-ocular sulci weak, the latter three-fifths as long as the moderately prominent, normal eye. Antennae simple, about equal to combined length of head and pronotum (with twenty distinct joints). Pronotum with disk flattened convex, rugulose, transverse sulci decided, medio-longitudinal carina subobsolete, cephalic margin transverse, caudal margin very feebly concave, showing very faint rounded production on each side at the juncture with the lateral lobes; disk well defined from the latter, the rounded margins evenly and slightly divergent caudad; lateral lobes very weakly rugulose and shining. Prosternal projection prominent, erect, triangular, with apex very sharply rounded. Tegmina represented by lateral, widely separated, narrowly ovate pads, reaching slightly beyond base of median segment and concealing a large tympanum. Mesosternal interspace weakly transverse. Dorsal surface of abdomen feebly rugulose, carinate, moderately clavate distad. Furcula represented by two small, broadly blunted knobs, separated by a deep, broad emargination of the tergite. Supra-anal plate shield-shaped, surface rather strongly concave laterad and with a broad medio-longitudinal sulcus distinct in proximal half. Cercus represented by a simple finger, reaching to near apex of supra-anal plate, gradually

[104] Comparison with material of that species may show generic differentiation, but even should such prove to be the case, *cribellatus* and *eumera* are undoubtedly much closer to each other than to any other known species.

tapering to the sharply rounded apex and weakly incurved, the curvature slightly strongest at the meso-distal point. Subgenital plate sharply conical, considerably longer than basal width and directed dorsad. Cephalic and median femora inflated and moderately curved. Caudal femora with carinae smooth and no dorso-distal projection. Caudal tibiae with seven (or eight) and a minute distal dorso-external and nine dorso-internal spines.

Allotype—♀;[105] probably [106] same data as type. [Hebard Collection.]

Differs from male as follows. Size larger, form more robust. Frontal costa slightly broader, even less prominent between antennae, with lateral carinae less decided in dorsal portion but slightly more distinct below median ocellus. Pronotum with broad concavity of caudal margin more pronounced, bluntly sub-carinate division of disk from lateral lobes more pronounced and even. Mesosternal interspace strongly transverse. Tegmina broader. Subgenital plate acute-angulate produced in a broad projection fitting between the ovipositor valves, which are evidently much worn and show weak apical curvature.

Coloration. Male. Dorsal surface of body seal brown, the rugae cacao-brown, which gives a pinkish cast. Antennae cacao-brown, becoming dark distad. Tegmina with numerous veins cacao-brown, the minute interspaces darker. Lateral portions of frontal costa and sutures of mouth-parts very dark; entire face and subocular portions of genae light pinkish cinnamon, ventral portions of pronotal lateral lobes pinkish cinnamon; a broad postocular band, occupying dorsal portion of pronotal lateral lobes, with ventral margin concave, and suffusing the pleura, shining dark greenish olive. Ventral surface apricot yellow, clear on abdomen, elsewhere suffused with brown. Cephalic and median limbs and caudal femora yellowish olive, the latter with ventral surface yellow showing a tinge of orange, the genicular areas maroon, margined ventrad and with brief pregenicular area pale scarlet red. Caudal tibiae with base pale scarlet red, remaining portions deep glaucous green, the spines bluish white and black tipped.

Female. Dorsal surface similar but more brownish, postocular band very dark brown. Limbs dark brown with an

[105] This specimen may represent a distinct, though very closely allied, species. The differences observed we prefer to consider, for the time, attributable to sexual or individual variation.

[106] The specimen is marked "Colombia," March 11, 1912. At that date Miller and Allen were at Almaguer, Cauca, but we believe it probable that this example, like the type, was actually secured at Cali, in February of that year.

olivaceous tinge, caudal femora with dorsal surface and sutures of external pagina paler brown, ventral surface very deep nopal red. Caudal tibiae exactly as in male.

Length of body, ♂, 14.7; ♀, 19.4: length of pronotum, ♂, 4; ♀, 4.4: caudal width of pronotal disk, ♂, 3.1; ♀, 4.4: length of tegmen, ♂, 3.3; ♀, 3: greatest width of tegmen, ♂, 1.4; ♀, 2: length of caudal femur, ♂, 9.8; ♀, 10: greatest width of caudal femur, ♂, 2.5; ♀, 2.6 mm.

This handsome insect is known only from the pair before us.

Group *Leptysmae*

LEPTYSMA Stål

1873. *Leptysma* Stål, Recensio Orth., I, p. 85. Type, selected by Rehn, *L. marginicollis* (Serville).

1906. *Cylindrotettix* Bruner, Journ. N. Y. Ent. Soc., XIV, p. 153. Genus monotypic. Genotype, *C. insularis* Bruner.

A topotypic series of *insularis*, in the author's collection, shows that the lack of sulcation of the fastigium in females, upon which character Bruner based his genus *Cylindrotettix*, is not shared by the male sex, with which that author was not acquainted. Faint sulcation is found in some females and the character is by no means adequate to warrant the recognition of that genus, which is consequently placed in the above synonymy.

Leptysma insularis (Bruner)

1906. *Cylindrotettix insularis* Bruner, Journ. N. Y. Ent. Soc., XIV, p. 153. [♀, Island of Trinidad.]

1908. *Cylindrotettix herbaceus* Bruner, Biol. Cent.-Amer., Orth., II, p. 252. [♀; Honduras; San Mateo, Costa Rica.]

Comparison of topotypic material of *insularis* with the single type of *herbaceus* in the author's collection (from San Mateo, Costa Rica), and other material before us, proves conclusively the synonymy indicated above. Though the fastigium is usually not sulcate in females of this species, weak sulcation is found to occur occasionally to varying degrees.

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 1 ♀.

This specimen agrees closely with the Costa Rican female before us. The fastigium shows a very weak but percurrent medio-longitudinal sulcation.

Length of body, 43.3; length of fastigium, 3.2; basal width of fastigium, 2; length of pronotum, 6; length of tegmen, 36.3; greatest tegminal width, 2.7; length of caudal femur, 16 mm.

Leptysma perlonga new species (Plate XV, figures 1 and 2.)

This insect is apparently the northern development of a widely distributed and plastic stock, found from Pará, Brazil to the Argentine. That phylum we believe should be recognized as *L. obscura* (Thunberg).[107]

It may be distinguished from *obscura* by its proportionately more elongate form, more elongate and slender fastigium and in the female by the more strongly ensiform antennae. The only male before us has the disto-lateral portions of the subgenital plate, before the specialized apical appendage, separated by a distinct interval and bluntly rounded.[108]

Type.—♂; Maripa, Rio Caura, Caura Territory, Venezuela. October, 1909. (M. A. Carriker, Jr.) [Academy of Natural Sciences of Philadelphia, Type no. 5362.]

Size large, form very slender, even more slender than in *obscura*. Head smooth, frontal costa as in *obscura*. Vertex with a transverse sulcus in the very narrow interocular space.[109] Fastigium elongate, appreciably over twice as long as the basal width, distinctly longer than eye; its dorsal surface with two weak, parallel, longitudinal carinae, broadly sulcate between these and weakly so latero-proximad; lateral margins gradually convergent, curving weakly distad to meet at the sharply rounded apex. Antennae strongly ensiform, distinctly longer than caudal femur. Pronotum cylindrical, its surface finely punctulate; median carina and transverse sulci very weak but distinct; metazona slightly over one-third pronotal length; cephalic margin truncate, caudal margin very broadly convex. Tegmina and wings very narrow, their apices aciculate. Supra-anal plate suddenly constricted at cercal apices, the distal portion rounded quadrate, surface proximad with a medio-longitudinal sulcus bounded by dark lateral carinae and a dark tubercle mesad on each side of these. Cerci curved sharply dorsad, the

[107] The type is described by Stål, Recensio Orth., I, p. 86, (1873). The names *L. dorsalis* (Burmeister), *L. filiformis* (Serville) and *L. uniformis* Bruner appear to be synonyms. Bruner and Rehn have separated the larger from the smaller Argentinian and Paraguayan individuals as *obscura* and *filiformis* respectively.

[108] So much variation is shown, however, in this feature in the series of *obscura*, that the exact form of this portion may prove in both these species to be individually decidedly variable.

[109] This feature is individually variable in the series of *obscura* before us.

erect portion flattened, subequal in width, with dark, truncate apex weakly oblique. Subgenital plate terminated disto-laterad in rounded triangular projections separated by a concave area of slightly greater width, the specialized distal process (characteristic of this group of the genus) suggesting in shape the elongate head of a large straight-billed bird, with a denticulation on each side slightly above what would be the ocular position. Caudal femora very slender; caudal tibiae expanding moderately distad, armed with (seven to ten in the series) dorso-external spines.

Allotype.—♀; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differs from male as follows. Size much larger, form even more attenuate, with fastigium proportionately more elongate, decidedly longer than eye. Antennae more strongly ensiform and exceeding length of caudal femur by a greater interval. Subgenital plate deeply and narrowly U-emarginate on each side of the acute, produced median portion. Ovipositor valves very short, as characteristic of genus.

Dorsal surface and antennae light brown, individually varying in shade. Other portions green, often faded to yellowish in dried material. The male from Parmak, Brazil, alone is of a brown phase, dark above, paler below and on the limbs, with a broad white band running across the genae from the ventro-caudal portion of the eye, margining the pronotal lateral lobes ventrad and also conspicuous on the pleura. It is the color phase lacking this band which apparently led Bruner to describe *L. uniformis*, a synonym of *L. obscura* (Thunberg), from Chapada, Matto Grosso, Brazil.

After the measurements of the series of *perlonga*, the dimensions of two pair, of what we believe to represent typical *obscura*, are given for comparison.

Measurements (in millimeters)

perlonga	Length of body	Length of vertex	Proximal width of vertex	Length of tegmen	Length of caudal femur
♂					
Maripa, Venezuela, *type*....	30.2	2.9	1.6	29.8	11.5
Parmak, Brazil.....	32	2.6	1.5	28.9	12.8
♀					
Palmar, Colombia.....	39.3	3.5	2	38	14.3
Maripa, Venezuela, *allotype*.	39	3.7	2.1	36.7	14.7
Maripa, Venezuela, *paratype*	40	3.4	2	37.8	14.2
Maripa, Venezuela, *paratype*	37.2	3.3	1.9	34.8	14
Mt. Roraima, Brazil.....	41.3	3.7	2.1	39	14.8
Mt. Roraima, Brazil.....	40.7	3.4	2.1	39	14.5
Dutch Guiana.....	41	3.8	2.1	40.2	15.2

obscura	Length of body	Length of vertex	Proximal width of vertex	Length of tegmen	Length of caudal femur
♂					
Piracicaba, Brazil.....	29.5	2.2	1.5	28	11.4
Piracicaba, Brazil.....	30	2.2	1.6	28	11.7
♀					
Piracicaba, Brazil.....	36.5	3	2.1	35.5	13.8
Piracicaba, Brazil.....	37.5	2.9	2	35	14.3

Specimens Examined 9; 2 males and 7 females.

Palmar, Rio Casenare, Boyacá, Colombia, IV, 1917, (M. A. Carriker, Jr.), 1 ♀.

Maripa, Rio Caura, Caura Territory, Venezuela, X, 1909, (M. A. Carriker, Jr.), 1 ♂, 3 ♀, *type, allotypes, paratypes*, [A. N. S. P.].

Parmak,[110] Coatinga River, Brazil, VIII, 11, 1911, (H. E. Crampton; in forest), 1 ♂, [A. M. N. H.].

Lower southern slopes of Mount Roraima,[111] Brazil, VIII, 14, 1911, (H. E. Crampton; in small patch of forest surrounded by grassy savannah), 2 ♀, [A. M. N. H. and Hebard Cln.].

Dutch Guiana, (ex Fruhstorfer Collection), 1 ♀.

OPSHOMALA Serville

1831. *Opshomala* Serville, Ann. Sci. Nat., XXII, p. 267. Genotype, by monotypy, *Opshomala viridis* Serville.

1870. *Stenacris* Walker, Cat. Dermapt. Saltat. Br. Mus., IV, p. 651. Genotype, designated by Kirby, *Stenacris concolor* Walker.

1873. *Arnilia* Stål, Recensio Orth., I, p. 85. Genotype, by monotypy, *Opsomala cylindrodes* Stål.

There appears to be no justification in considering any of the genotypic species cited above to be generically distinct.

Kirby has followed Rehn correctly in synonymizing *Arnilia* under *Stenacris*, which in turn is now placed under *Opshomala*, a name subsequently emended by some authors to *Opsomala* and *Opomala*.

Brunner proposed *Chrostheipus* as a new name for *Opomala* Stål, an emendation of *Opshomala* Serville; Brunner's name, in consequence, has no valid standing.[112]

[110] This locality is about fifty miles due west of the Ireng River, on the 4th degree, north latitude, at about 2500 feet elevation.

[111] This locality is about eighty miles due west of the Ireng River, a little north of the 4th degree, north latitude, at 3600 feet elevation.

[112] This agrees with Kirby's assignment. Bruner has no justification in attempting to resurrect *Chrostheipus*, the genotype of which is *viridis* and not *varipes*, as he has assumed. See Ann. Carnegie Mus., VIII, p. 89, (1911).

Opshomala colombiae (Bruner) (Plate XV, figures 5 and 6.)

1908. *Arnilia colombiae* Bruner, Biol. Cent.-Amer., Orth., II, p. 258. [♂, ♀; Don (nec San) Diego, Magdalena, Colombia.[113]]

Cali, El Valle, V, 26, 1914, (H. S. Parish), 1 ♀, [A. N. S. P.].
Aguadita, Cundinamarca, VI, 1916, (from A. Maria), 1 ♂.

Comparison with the originally described series[114] shows the identity of the male here recorded.

The species is nearest *O. fissicauda* (Bruner), known from Trinidad and the Guianas. In that species the male subgenital plate has the latero-distal portions heavier and more ascendant, with horizontally lamellate section less conspicuous, and with a single minute dorsal projection proximo-mesad of these (see plate XV, figures 3 and 4). In general contour the species of this section of the genus agree so closely that we assign the Cali female only on its size agreement with the Aguadita male. Decided size variation, however, is evident in the species, as is shown by the following measurements (in millimeters).

♂	Length of body	Width across eyes	Length of pronotum	Length of tegmen	Length of caudal femur
Don Diego, *type*	27	3.6	4.7	23	14.2
Aguadita	25	3.4	4.2	20.1	12.8
♀					
Don Diego, *allotype*	36.5	4.1	6	31.8	18
Don Diego, *paratype*	36	4.3	6.7	31.3	19

Opshomala chocoensis new species (Plate XV, figures 7 and 8.)

This species shows a higher development of the male genitalic type found in *O. colombiae* (Bruner). The subgenital plate is developed distad in two scythe-like lamellae, which, in large part horizontal and incurved, have their apices directed upward and attingent. Between the bases of these, surmounting a well raised neck, is a delicate, horizontal, flat, elongate oval plate, its caudal extremity above the apices of the lamellae. Like the other known species of this group, this insect apparently shows no other specific diagnostic characters of value.

[113] This material was secured by H. H. Smith, in the month of May, 1901.

[114] We select the male described by Bruner, and here figured, as single type of the species. This specimen has most kindly been loaned us for study by the Carnegie Museum.

Size variation is great and intensification or recession accounts for such color differences as are found.

Type.—♂; Boca Murindó, Intendencia del Chocó, Colombia. February 9, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 907.]

Size medium, form slender, slightly more robust than in the genotype *O. cylindrodes* (Stål).[115] Interocular space one-half as wide as first antennal joint. Fastigium as long as its proximal width including the comparatively prominent lateral ocelli, its surface medio-longitudinally obscurely subsulcate. Frontal costa decidedly sulcate to opposite lateral ocelli. Pronotum cylindrical, with weak shoulders indicated caudad; its surface finely impresso-punctulate, this very weak mesad, decidedly weaker than in *colombiae*. Tegmina and wings fully developed, extending decidedly beyond caudal femora, the former with apices acute. Prosternal spine cylindrical, with apex rounded. Supra-anal plate with lateral margins of proximal portion thickened and raised, the plate then suddenly very strongly narrowed so that the distal portion projects as a slender finger, lying in a groove between subchitinous plates. Cerci directed ventrad, then suddenly bent dorsad, the slender distal portion erect, with aciculate apex inclined slightly cephalad. Subgenital plate highly specialized, as described above, the oval plate with largest end caudad and sub-bilobate. Caudal tibiae moderately enlarged distad, with dorsal margins in that portion finely lamellate, external margin armed with seven (rarely eight in the series) small, delicate spines.

Allotype.—♀; same data as type. [Hebard Collection.]

Differs from male as follows. Size larger, form more robust. Interocular space two-thirds as wide as first antennal joint. Fastigium broader, slightly shorter than proximal width, its sulcation more distinct. Antennae less elongate. Subgenital plate U-emarginate on each side of the acute, produced median portion. Ovipositor valves very short, heavy and strongly dentate.

General coloration courge green, shading to blackish on genae, lateral lobes of pronotum and pleura above a broad whitish band. Antennae greenish brown. Tegmina hyaline except in courge green proximal portion, tinged with persian blue toward costal margin. Wings hyaline, colorless except costal margin and in proximal portion, where they are tinged with persian blue. Ventral surface and femora olive-ocher, the caudal femora often more greenish distad, the tibiae all

[115] Comparison is made with Brazilian material in the Philadelphia Collections.

more greenish. Abdomen olive-ocher, with dorsal surface dark orient blue. Caudal tibiae deep chrysolite green, caudal metatarsi and apex of last joint often yellowish or suffused with reddish brown.

Measurements (in millimeters)

♂	Length of body	Width across eyes	Length of pronotum	Length of tegmen	Length of caudal femur
Boca Murindó, *type*....	26.5	3.7	4.8	22.8	13.8
Boca Murindó, *paratype*	24.3	3.2	3.9	21	13.2
♀					
Boca Murindó, *allotype*	32.8	4	5.7	26.4	17
Boca Murindó, *paratype*	32.2	3.9	5.7	25.8	16.8
Boca Murindó, *paratype*	33.2	4.1	5.8	27.2	16.4

In addition to the described pair, a series of four male and three female paratypes, bearing the same data, is before us.

Group *Stenopolae*

Oxyblepta limbatipennis Stål

1873. *S*[*tenopola*] (*Oxyblepta*) *limbatipennis* Stål, Recensio Orth., I, p. 85. [♂; Remedios, [Antioquia], Colombia.]

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 1 juv. ♀.

Muzo, Boyacá, 1921, (from A. Maria), 1 ♀.

From the unstudied collections before us, it is evident that this species is abundant in Panama and is apparently the insect recorded by Giglio-Tos as *Stenopola xanthochlora* Marschall, from Rio Cianati and Laguna Pita, Darien.[116]

Oxyblepta eumera new species (Plate XIV, figure 2.)

Closely related to *O. limbatipennis* Stål, the present insect may be distinguished by the slightly shorter fastigium, entire dorsal surface which is bright green, instead of brown varying to yellowish, and caudal femora which are strikingly orange proximad and bright green distad.

These species are distinctly heavier than the series of *O. xanthochlora* (Marschall), recorded by Rehn from Igarapé-Assú, Pará, and Pará, Brazil, with which insect *limbatipennis* agrees closely in other respects.

[116] Boll. Mus. Zool. Anat. Comp. Univ. Torino, XII, no. 301, p. 4, (1897).

Type.—♂; Andagoya, Antioquia (Chocó), Colombia. April 28, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 888.]

Size medium small and form slender, as characteristic of the genus, much as in *limbatipennis*. Interocular space half as wide as proximal antennal joint, slightly wider than in *limbatipennis*. Fastigium distinctly shorter than in that species,[117] no longer than its basal width; lateral ocelli moderately large and visible from above, the lateral margins of the vertex finely carinate, weakly convex-convergent to the blunt apex; surface of vertex weakly convex and impresso-punctulate. Frontal costa smooth and flattened to median ocellus, not sulcate; lateral outline of face feebly concave, its lateral carinae well developed and percurrent. Interocular space, frontal costa and lower portions of genae caudad alone not impresso-punctulate, occiput and dorsal surface of caudal femora weakly so, this decided on other portions of head, pronotum and pleura. Antennae linear, intermediate in length between caudal femur and tegmen. Pronotum nearly cylindrical, medio-longitudinal carina very weak, transverse sulci weak, caudal margin of disk broadly convex but showing some obtuse-angulation.[118] Prosternal spine slender and acute. Tegmina and wings fully developed, the former very narrow, subequal in width distad to the broadly rounded apex. Genitalia simple, agreeing closely with *limbatipennis*. Small, black furcula present. Supra-anal plate narrowed suddenly distad, the apical portion shield-shaped, a small black tubercle proximo-laterad on each side, this more prominent than in *limbatipennis*. Cerci heavy proximad, suddenly bent dorso-caudad, the lamellate distal portion subequal in width, with apex rounded and darkened on its inner margin. Subgenital plate simple, impressed on each side, with narrow apex blunt. Caudal tibiae decidedly ampliate distad, with dorsal surface there concave and lateral margins lamellate.

Allotype.—♀; same data as type. [Hebard Collection.]

Agrees closely with male, differing as follows. Size larger. Interocular space two-thirds as wide as proximal antennal joint. Antennae only as long as caudal femur not including the genicular portion. Caudal margin of pronotal disk very broadly convex, without trace of angulation. Ovipositor valves very short, their dorsal and ventral working margins armed with short teeth, the distal tooth curved, short but acute.

Sexes exactly similar in their brilliant and distinctive coloration. Head and pronotum, except for a broad postocular band

[117] Individually, however, showing some variation in these species.

[118] This is individually variable, many specimens having this margin evenly convex.

of blackish brown, and dorsal field of tegmina, courge green, often more yellow laterad. Never is a trace of the paler coloration, so conspicuous in *limbatipennis*, shown below the eye and dark postocular bar. Eyes and antennae verona brown, the latter slightly paler on their ventral surface. Occiput and pronotum sometimes with a trace of a medio-longitudinal dark marking. Tegmina with other portions blackish brown except for the costal margin which is narrowly colorless distad; dorsal field distad toward costal margin sometimes tinged with delft blue. Wings hyaline, moderately iridescent, tinged distad with dark brown, particularly in the anterior field; remaining portions faintly tinged with venetian blue, this stronger proximad, the veins delft blue. Ventral surface yellow brown, sides of abdomen wax yellow, its dorsal surface deep delft blue. Cephalic and median femora wax yellow becoming greenish yellow distad, their tibiae courge green. Caudal femora light cadmium (in some more yellow, in others orange mesad) in proximal two-thirds, shading gradually in remaining portion to mineral green, with dorsal portions of genicular area blackish brown. Caudal tibiae porcelain blue (a deep glaucous-blue); spines buffy, black tipped.

Measurement (in millimeters)

	Length of body	Width across eyes	Length of pronotum	Length of tegmen	Length of caudal femur
♂					
Andagoya, *type* .	17.7	3	3.7	14.7	10.4
Andagoya, *paratypes*	17.2–17.4	2.9–3	3.4–3.7	14.4–14.8	10.8–11
Boca Murindó, *paratypes*	19–19.6	3.2–3.3	3.9–4	15.9–16.9	11.2–12
♀					
Andagoya, *allotype*.....	21.8	3.5	4.4	18	12.7
Andagoya, *paratypes*	22–22.3	3.5–3.7	4.7–4.7	16–18.3	12.7–12.9
Boca Murindó, *paratype*.....	25	3.9	5	21	13.8

Except for the larger size, the Boca Murindó series agrees closely with that from Andagoya.

Specimens Examined: 18; 12 males and 4 females.

Andagoya, Antioquia (Chocó), IV, 22, 1918, (M. A. Carriker, Jr.), 6♂, 3 ♀, *type*, *allotype* and *paratypes*.

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 6 ♂, 1 ♀, *paratypes*.

Group *Tetrataeniae*

Cornops longipenne (DeGeer)

1773. *Acrydium longipenne* DeGeer, Mém. l'Hist. Nat. Ins., III, p. 501, pl. 42, fig. 9. [Surinam.]

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 1 ♂, 2 ♀.

These specimens agree closely with a topotypic female in the Academy Collection.[119]

Length of body, ♂, 20; ♀, 26.2 and 26.2: length of tegmen, ♂, 20.5; ♀, 24.2 and 25.4: length of caudal femur, ♂, 12.7; ♀, 14.3 and 15.8 mm.

Group *Coscineutae*

Poecilocloeus santamartae new species (Plate XV, figure 9.)

After careful comparison with a number of yet unreported Brazilian and Peruvian species of Bruner's *Poecilocloeus*,[120] we are able to state that *santamartae* is a very distinctive species in which some difference is found in certain characters usually of generic importance. Such difference is, however, in our opinion, not sufficient in the present case to warrant generic separation, at least until the forms of the genus and its allies are better known.

The somewhat streaked and grayish color of this insect indicates that it probably lives on bark and among twigs of the forest, rather than in vine tangles, where from their coloration and form we would expect to find most of the species of *Poecilocloeus*.

The present species differs very widely from all other forms of this and allied genera known to us not only in color and color

[119] See Rehn's discussion of this species, Trans, Amer. Ent. Soc., XLII, p. 285, (1916).

[120] Described in Horae Soc. Ent. Rossicae, XXXIX, p. 11, (1910). To this genus we find belong two of Rehn's species, *Proctolabus bullatus*, described from Peru in 1908, and *Bucephalacris falcifer*, described from Pará, Brazil, in 1918. For the genus *Bucephalacris*, Giglio-Tos cited the single species *bucephala* (Marschall), which species is consequently the genotype. Unfortunately Bruner designated the same species as genotype of his *Chrysopsacris* and so the latter is a synonym of the former. Of the other species which have been referred to that genus, *Jodacris? costaricensis* Rehn is a member of the genus *Anniceris*, while *Chrysopsacris atrocephala* Bruner represents a distinct and as yet undescribed genus.

pattern but also in the male genitalia, which are distinctively and highly specialized.

Type.—♂; Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. Elevation, 4000 to 5000 feet. July 10, 1913. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 894.]

Size small, form medium. Head with eyes prominent; interocular space very narrow, less than half as wide as first antennal joint; vertex with a weak medio-longitudinal sulcus; fastigium pentagonal, nearly half again as long as its greatest width (mesad), surface moderately impressed between the weak disto-lateral and blunt distal carina (the latter forming the truncate apex). Frontal costa produced in dorsal portion, there subequal in width, slightly wider than first antennal joint, its surface flat, with impressed punctae except in dorsal portion; below median ocellus indicated by a shallow sulcus bounded by weak carinae, disappearing just before clypeal suture; lateral carinae of face moderately distinct, infra-ocular sulcus broad but distinct; surface of face and genae moderately rugose. Face moderately oblique, in lateral outline showing scarcely any concavity. Antennae missing. Maxillary palpi not enlarged. Pronotum with definition between disk and lateral lobes distinct only on metazona; disk with cephalic margin moderately convex, weakly and roundly but broadly emarginate mesad, caudal margin convex; transverse sulci distinct; medio-longitudinal carina only on metazona, there distinct; surface of pronotum with elongate hairs and somewhat roughened, impresso-punctulate on metazona. Prosternum swollen with median tubercle very weak. Tegmina and wings somewhat reduced, shorter than caudal femur; the former with principal veins all longitudinal, its apex broadly rounded and costal margin showing scarcely any convexity meso-proximad, its surface with elongate hairs; wings cycloidal. Furcula absent, but tergite preceding supra-anal plate cleft mesad. Supra-anal plate simple, lateral margins weakly convex-convergent to the truncate apex, surface smooth except for a weak medio-longitudinal sulcation proximad. Cercus vertically broad, curving evenly inward, distad with dorsal portion very suddenly emarginate, the ventral portion there produced in two heavily spiniform, curved extremities, the first and upper the smaller, directed dorso-mesad, the other continuing the curvature of the shaft, but more strongly curved, its apex touching the impressed disto-dorsal, lateral area of the subgenital plate. Pallium moderately produced as a high longitudinal ridge between the apices of the cerci. Subgenital plate very short, bluntly rounded, with a brief vertical carina dorso-distad, on each side

of which the surface of the plate is broadly impressed. Cephalic and median limbs missing. Caudal femora supplied with long hairs, with carinae smooth, the dorsal not produced at genicular extremity; ventral margin of genicular area rather strongly convex, disto-ventral projections acute-angulate. Caudal tibiae rather heavily supplied with long hairs, bearing seven (but no distal) dorso-external and nine dorso-internal spines. Second joint of caudal tarsus nearly equal in length to first (third missing).

Postocular portion of genae and greater portion of pronotal lateral lobes blackish; mouth-parts, vertex, occiput and dorsum of pronotum mikado brown, the occiput with blackish markings. Face, subocular portion of genae, cephalic margin of pronotum narrowly and ventral portion of pronotal lateral lobes broadly tawny olive. Pleura blackish with two large areas of tawny olive. Tegmina with veins tawny olive, the minute intervals darker. Ventral surface dirty wax yellow (probably bright in life). Caudal femora garnet brown, deepening to maroon distad and paling to brilliant nopal red internally, with two broad transverse bands of honey yellow across dorsal surface and external pagina, the distal continued some distance across internal surface. Caudal tibiae smoke gray, showing a faint reddish tinge distad, with dorsal surface black except in proximal portion, spines and spurs black distad. Caudal tarsi smoke gray, showing a faint reddish tinge.

Length of body, 14;[121] width across eyes, 3.2; length of pronotum, 2.7; caudal width of pronotal disk, 1.9; length of tegmen, 7.1; length of caudal femur 8.7 mm.

The type of this unusual insect is unique.

Coscineuta coxalis (Serville)

1839. *Acridium coxale* Serville, Hist. Nat. Ins., Orth., p. 672. [♀ : Peru; Colombia.]

Boca Murindó, Intendencia del Chocó, II, 10, 1918, (M. A. Carriker, Jr.), 1 ♂, 1 ♀.

El Tambo, Intendencia del Chocó, III, 30, 1918, (M. A. Carriker, Jr.), 1 ♀.

Rio Cauca near Medellin, Antioquia, 1894, (R. W. Denton), 1 ♀, [Museum of Comparative Zoology].

Puerto Berrio, Antioquia, X, 1913, (from A. Maria), 1 ♀.

This handsome and distinctive insect has also been recorded from Remedios, Antioquia, and Punta di Sabana and Tin-Tin, Darien.

[121] Approximate, proximal portion of abdomen missing.

Coscineuta trochilus (Gerstaecker)

1873. *Acridium trochilus* Gerstaecker, Ent. Zeit. Stettin, XXXIV, p. 189. [♀; Bogotá, [Colombia].]

Honda, Tolima, III, 1913, (from A. Maria), 1 ♀.

The present specimen is very possibly from very near the type locality. Though the type was labelled "Bogotá," it unquestionably came from the tropical lowlands and, in the present case, probably from the Magdalena forests.

The striking and distinctive markings of this insect make it most readily recognizable and, having located the species, its position in the genus *Coscineuta* is evident. Kirby was in error in placing *trochilus* in the genus *Ophthalmolampis*,[122] as is also the case for Gerstaecker's species *bracteata* and *pulchripes*, which likewise belong to *Coscineuta*.

In structure the female before us agrees closely with that sex of *C. coxalis* (Serville). The head is blackish green, with face and occiput showing green slightly more strongly, an irregular patch of buff-yellow above the clypeus on each side of the frontal costa. Antennae black. Eyes auburn with some metallic luster. Pronotum with cephalic margin and caudal margin of disk black; disk with metazonal portion deep carmine, other portions rich and very deep olive with rugae yellowish on disk, dorso-cephalic and metazonal portions of lateral lobes. Pleura blackish with rugae olivaceous and a suffusion of yellowish toward the caudal coxae. Tegmina bister with veins tawny olive. Wings as in *coxalis*, hyaline weakly tinged with deep blue, particularly toward their bases. Ventral surface shining black, with a large area of buff-yellow on mesosternum and a larger similar area on metasternum, as in *coxalis*. Abdomen shining black, the segments each with an olive black band slightly yellowed laterad on the proximal segments; ovipositor valves clay color. Cephalic coxae black, median and caudal coxae nopal red. Cephalic and median limbs black, the median femora with an external streak of greenish black. Caudal femora with genicular areas, ventral surface and dorsal carina buff yellow, external surface black with an olivaceous tinge to near ventral margin, internal surface the same in dorsal portion,

[122] Syn. Cat. Orth., III, p. 389, (1910).

ventro-external surface with a row of round black flecks, as in *coxalis*. Caudal tibiae nopal red with brief distal and more extensive proximal portions black, spines and tarsi black.

Group *Phaeopariae*

Phaeoparia annulicornis Stål

1873. *P[haeoparia] annulicornis* Stål, Recensio Orth., I, p. 57. [♂, ♀; Remedios, [Antioquia], Colombia.]

Andagoya, Antioquia (Chocó), IV, 22, 1918, (M. A. Carriker, Jr.), 5 ♂, 8 ♀.

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 1 ♀.

This handsome species is closely related to the Panamanian *P. rotundata* Stål. It differs in the shorter antennae, proportionately shorter tegmina and wings (this the more decided in the female sex), with apices of the former distinctly truncate in the males, more strongly so in the females, and in the male sex in the slightly less prominent furcula and more elongate supra-anal plate.

Bruner, in his key in the Biologia, did not realize that in the genus *Phaeoparia* the tegmina are immaculate (or marked only with a few inconspicuous dots), but with dorsal surface pale in the males; maculate in the females with a decidedly variable number of dark shiny patches, but with ground color of all the fields the same.

Length of body, ♂, 24 to 24.2; ♀, 32 to 38.5: length of pronotum, ♂, 5.1 to 5.4; ♀, 7 to 8.2: caudal width of pronotal disk, ♂, 2.2 to 2.4; ♀, 3 to 3.8: length of tegmen, ♂, 15.7 to 16.1; ♀, 19 to 24.8: length of caudal femur, ♂, 15.4 to 15.9; ♀, 18.8 to 22.3 mm.

Phaeoparia carrikeri new species (Plate XIV, figure 3; plate XV, figures 10, 11 and 12.)

This handsome insect is closely related to *P. annulicornis* Stål, agreeing in form, palpi and genitalia in the male. It differs in the much more elongate tegmina and wings, the more distinct truncation of the former and the coloration of the latter, which is orange rather than pink. In these features alone, close agreement with *P. maculipennis* Stål is shown, under which species we have discussed the numerous differences.

Type.—♂; Córdoba, Rio Dagua, El Valle, Colombia. May 23, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 889.]

Size medium, form slender for the genus. Head with U-shaped carina and impression between eyes decided, fastigium declivent and hardly longer than broad, frontal costa percurrent and sulcate, with strong lateral carinae from median ocellus to its juncture with fastigium. Occiput with surface very finely and evenly wrinkled, head elsewhere very finely rugulose and impresso-punctate on face. Maxillary palpi with distal joints flattened and ampliate. Pronotum with disk very narrow, its lateral margins nearly parallel and best defined by the contrast between dorsal and lateral coloration; cephalic margin feebly convex, caudal margin produced and forming slightly more than a right-angle with apex blunt but with sides moderately concave; medio-longitudinal carina distinct and percurrent, cut by the transverse sulci. Entire surface of pronotum and pleura rather finely impresso-punctulate, the pronotal disk with a few inconspicuous rugae on each side at the cephalic margin. Prosternal spine long and slender. Tegmina and wings well developed, surpassing apices of caudal femora, the former and the anterior field of the latter with apex obliquely truncate, but neither concave or showing any production of the costal angle. Furcula represented by minute finger-like projections, separated by a distance equal to half that between the cercal bases. Cerci tapering and flattened from the moderately stout bases to slightly less than distal fourth, the distal portion slender and curving weakly inward with apex rounded. Supra-anal plate with length of proximal portion equal to its median width, its sides gradually converging and bearing a minute, stout tooth meso-distad, the surface weakly convex on each side, with a medio-longitudinal sulcus to a transverse line between the teeth, thence with a medio-longitudinal carina to base of distal portion; distal portion formed by a large rectangulate emargination of the sides with angle rounded, slightly longer than broad with sides parallel to the weakly convex apex. Subgenital plate produced distad in a lamellate plate as broad as long, with disto-lateral angles rounded and distal margin transverse. Caudal femora with dorsal carina forming a minute genicular denticle. Caudal tibiae lacking a dorso-distal external spine.

Allotype.—♀; same data as type. [Hebard Collection.]

Agrees closely with male, differing in the decidedly larger size and slightly more robust form. Interocular space broader. Surface slightly rougher, the rugae at the cephalic margin of the pronotal disk more distinct. Tegmina with oblique truncation

at apex showing weak concavity. Subgenital plate laterad closely embracing the moderately elongate ovipositor valves, which have their margins unarmed, but distad curve very strongly to their acute apices.

Coloration. Male. Face, occiput, disk of pronotum and dorsal field of tegmina clay color. Maxillary palpi with last two joints ochraceous-buff. Antennae ferruginous, showing traces of buffy annuli; paler proximad. Eyes genae, lateral lobes of pronotum, pleura, lateral portions of tegmina and all but exposed portion of ventral surface of caudal femora dark chestnut brown; external portion of ventral surface of caudal femora blackish, bordered externally by a very narrow buffy line proximad. Wings hyaline tinged with orange buff proximad, elsewhere shading to bittersweet orange. Ventral surface buffy, suffused with blackish cephalad and laterad on plate formed by mesosternum and metasternum, abdomen dorsad carnelian red with ventral surface of distal portion rufous. Cephalic and median femora and tibiae parrot green with numerous minute flecks of apricot yellow,[123] tarsi all reddish brown. Caudal tibiae brilliant scarlet red becoming slightly darker proximad, the spines and spurs black tipped.

Female. Head, pronotum, pleura, tegmina and caudal femora chestnut brown, the latter marked ventrad as in the male. Maxillary palpi as in that sex. Antennae ferruginous, showing weak annuli of kaiser brown. Ventral surface similar to male except that the blackish suffusion is much more extensive, with abdomen dorsad and distad hazel. Tegmina showing small blackish, glossy flecks proximad (larger in paratype) and with traces of an oblique series of minute whitish points just beyond the middle (also more prominent in paratype), with distal portion faintly marbled. Cephalic and median limbs brown with minute flecks of ochraceous-buff. Caudal tibiae blackish brown, becoming chestnut brown at apices, the spines and spurs black tipped.

The measurements of type and allotype are given first. Length of body, ♂, 25.8 and 26.4; ♂, 35 to 38: length of pronotum, ♂, 5.1 and 5.3; ♀, 7.1 to 7.8: caudal width of pronotal disk, ♂, 2.2 and 2.3; ♀, 3.2 to 3.7: length of tegmen, ♂, 19.3 and 19.8; ♀, 25.2 to 25.8: length of caudal femur, ♂, 15.2 and 15.9; ♀, 19.5 to 21.1 mm.

In addition to the type and allotype, there are one male and two female paratypes before us, bearing the same data.

[123] As in *annulicornis*.

Phaeoparia maculipennis Stål

1878. *P[haeoparia] maculipennis* Stål, Bih. Svenska Vet. Akad. Handl., v, no. 4, p. 58. [♀, Colombia.]

1913. *Phaeoparia linea-alba* Bruner (not *Gryllus linea-alba* Linnaeus, 1764), Ann. Carnegie Mus., VIII, p. 489. (In part.) [♂; Bogotá,[124] Colombia.]

Don Diego, Magdalena, V, 1901, (H. H. Smith), 1 ♂, 1 ♀, [Carnegie Museum.]

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 3 ♂.

The species *linea-alba*, from Stål's diagnosis,[125] is a decidedly larger insect (expanse of tegmina 62 mm.). From Dutch Guianan, Peruvian and Bolivian material before us of that species, we are able to state that *maculipennis* differs further in having the vertex decidedly declivent and less produced, the tegminal apex blunter and less produced, the median oblique band of minute white flecks varying from weak to obsolete, the wings (pinker) tinged with light salmon-orange rather than orange-buff and not suffused distad, the much more highly specialized male genitalia with subgenital plate blunt, not acutely produced and the caudal tibiae which are peach red instead of blackish brown in the male sex.

Loan of material from the Carnegie Museum has enabled us to correct the identification of the specimen from "Bogotá," which locality is certainly in error, the specimen having undoubtedly come from a lower elevation.

Nearest relationship is shown by the previously undescribed male of *maculipennis* to *P. carrikeri* here described, that insect, however, agreeing much more closely with *P. annulicornis* Stål. We find *maculipennis* to differ in being decidedly more robust, with distal joints of maxillary palpi more slender, antennae shorter and heavier and not annulate, the male with head and pronotum almost as dark dorsad as laterad, the tegmina and wings very similar to those of *carrikeri*, more truncate and with wings decidedly less pink than in *annulicornis*, the furcula still more widely separated, the cerci not only incurved but with apices decurved, the supra-anal plate much

[124] We have examined the female from Dutch Guiana, belonging to the Carnegie Museum and also recorded at the same time, and find that it represents true *linea-alba*.

[125] Recensio Orth., I, p. 57, (1873).

wider, with lateral portions produced in large acute angulations, meso-distal production broader than long and subgenital plate with apex more broadly truncate. One of the most striking differences in the female sex is the pronotal disk, which is very much broader in proportion to its length in *maculipennis* than in *carrikeri*.

Length of body, ♂, 25.7 to 27.8; ♀, 42.8: length of pronotum, ♂, 5.2 to 5.3; ♀, 7.2: caudal width of pronotal disk, ♂, 3.2 to 3.2; ♀, 4.9: length of tegmen, ♂, 21.3 to 23; ♀, 31.9: length of caudal femur, ♂, 15.2 to 17.2; ♀, 23.2 mm.

Phaeoparia amblyceps new species (Plate XIV, figure 4; plate XV, figure 13.)

This small dull colored insect, with large blunt head, cylindrical pronotum which is strongly emarginate meso-caudad and lateral pad-like tegmina has very scant resemblance to the winged forms of the genus. When, however, we compare it with *P. emarginata* Stål,[125] we see that it is merely a further development away from the usual type, showing extreme generalization through simplification of structure.

When compared with females of *emarginata*, the present female may be readily distinguished by the smaller size, more robust form, proportionately larger and broader head, much stronger meso-caudal emargination of the pronotum, immaculate tegmina but maculate sides of the abdomen and different coloration of ventral surface of caudal femora.

Stål examined the unique male type of Brunner's *Pezotettix megacephala* and has placed that species in the genus *Aristia*. If this is true, *amblyceps* and *megacephala* show very unusual convergence. These species agree very closely in the majority of characters, *megacephala* known from a male of decidedly greater proportionate size and more complex color pattern than will probably be found in the yet unknown male of *amblyceps*. Should Stål be in error, and *megacephala* be found to lack the external disto-dorsal spine of the caudal femora, that species would certainly have to be transferred to *Phaeoparia*.

Type.—♀; Susumuco,[126] Cundinamarca, Colombia. Elevation, 2600 feet. (From A. Maria.) [Hebard Collection, Type no. 890.]

[125] Venezuelan material of the species is in the unstudied Academy collections.
[126] This locality is near Villavicencio, Intendencia del Meta.

Size small, form robust for the genus. Head very large and blunt. Interocular space three times as wide as proximal antennal joint. Vertex with U-shaped depression decided but with bounding carina only laterad. Fastigium declivent, transverse, three times as broad as long. Frontal costa percurrent, broadly sulcate. Occiput and genae almost smooth, other portions of head very finely impresso-punctulate, pronotum and pleura more strongly so. Face with decided lateral carinae but no infra-ocular sulcus. Maxillary palpi not ampliate. Pronotum nearly cylindrical with tubercles on each side of median point on cephalic margin subobsolete; cephalic margin nearly transverse, caudal margin weakly concave laterad, moderately convex dorso-laterad and meso-dorsad forming a large subrectangulate emargination; medio-longitudinal carina faintly indicated on prozona only to first transverse sulcus, more decided on the very narrow metazona, transverse sulci distinct. Prosternal spine rather long and slender. Tegmina represented by very narrowly ovate lateral pads, extending to near caudal margin of median segment and largely concealing the ample tympanum. Dorsal surface of abdomen carinate. Ovipositor valves short with cutting margins unarmed, the apices strongly curved (blunt, apparently from wear, in the present specimen). Caudal femur with a few minute serrulations proximad on dorsal carina, which terminates in a small but decided genicular denticle. Caudal tibia lacking a distal dorso-lateral spine.

General coloration walnut brown. Antennae with traces of darker annuli distad. Tegmina immaculate. Abdomen proximad with each tergite marked with an oblique suffusion of blackish brown. Ventral surface vinaceous-rufous. Caudal femora in external half of ventral surface brazil red. Caudal tibiae brown, darker internally, spines black distad.

Length of body, 24.2; greatest width of head, 5; length of pronotum, 4.3; total caudal width of pronotum, 4.8; length of tegmen, 3.8; greatest tegminal width, 1.6; length of caudal femur, 13.4 mm.

The type of this extraordinary insect is unique.

Aristia bicolor new species (Plate XIV, figure 5; plate XV, figure 14.)

This insect, which is uniformly dark except for the pale vertex, occiput, dorsum of pronotum and dorsal surfaces of the tegmina, is nearest the genotype *A. mordax* (Stål), described from Antioquia. It may be readily distinguished by the minute tubercles of the pronotal disk cephalad and the much more reduced tegmina, which are ovate but subattingent.

In general appearance a decided superficial resemblance is shown by this insect to the North American acridine *Napaia gracilis* McNeill, the present species being, however, more robust.

Type.— ♀ ; Las Mesitas, Cundinamarca, Colombia. Elevation, 3200 feet. May, 1918.. (From A. Maria.) [Hebard Collection, Type no. 891.]

Size below medium, form medium for the genus. Interocular space over twice width of proximal antennal joint, U-shaped depression distinct, narrow and subcingulate, fastigium with weak bounding carinae which are divided at its apex by the percurrent sulcus of the frontal costa; lateral carinae of frontal costa weaker below median ocellus and subobsolete near clypeal suture. Fastigium horizontal, roughly triangular, as long as broad, prominent. Occiput and genae almost smooth, with weak rugae; face rugoso-impresso-punctate, the lateral carinae distinct, coarser but lower carinae sharply delimiting face from genae in place of infra-ocular sulci. Antennae distinctly but not decidedly flattened proximad. Maxillary palpi not ampliate. Pronotum and pleura rugoso-impresso-punctate, with two pairs of slightly heavier, elongate tubercles near transverse cephalic margin of pronotal disk, caudal margin of same very broadly and bluntly obtuse-angulate produced; medio-longitudinal carina very weak except on metazona, transverse sulci weak; disk defined in color and separated from lateral lobes in proximal and caudal portions by blunt carinae as well, these parallel to first sulcus, then weakly divergent to principal sulcus, again parallel on metazona; lateral lobes of pronotum with a weak broad ridge running obliquely from principal sulcus on disk to a median point on the cephalic margin.[127] Prosternal spine large and elongate, curving slightly cephalad to the rounded apex. Tegmina represented by ovate, subattingent pads, shorter than pronotum but with dorsal and lateral fields sharply defined by both contour and color. Dorsal surface of abdomen carinate. Ovipositor valves elongate, with cutting margins unarmed but subcrenulate, the apices acute and moderately curved. Caudal femora with dorsal, and to a less degree the dorso-external, carina with a few very small serrulations, the dorsal carina terminating in a minute genicular denticle. Caudal tibiae with a small distal dorso-external spine, this slightly shorter than the shortest spur.

General coloration rich and deep chestnut brown, becoming blackish latero-dorsad on tegmina. Vertex, occiput and disk of pronotum clay color, dorsal field of tegmina pinkish buff (as are probably the other dorsal portions in fresh material).

[127] This is apparently a generic characteristic, the ridge differing in position, however, in the different species.

Antennae slightly darker distad. Ventral surface of median femora blackish in type, of the general coloration in a paler paratype. Internal portion of ventral surface of caudal femora greenish black, paling to greenish yellow proximad; external portion blackish in type, of the general coloration in a paler paratype, with bounding carina of pagina paler. Caudal tarsi entirely and caudal tibiae distad vandyke red, the latter decidedly duller proximad, spines black tipped.

The measurements of the type are given first: length of body, 30 to 30.8; length of pronotum, 5.2 to 5.7; caudal width of pronotal disk, 2.9 to 3.1; length of tegmen, 5.9 to 5.9; greatest width of tegmen, 3.3 to 3.3; length of caudal femur, 15.8 to 15.8 mm.

In addition to the type, two paratypic females are at hand, bearing the same data.

Aristia oxycodia new species (Plate XIV, figure 6; plate XV, figures 15 and 16.)

This handsome insect, though having vestigial, slender, lateral tegmina, shows a specialized and distinctive contour. Its generic position is readily recognized by the acute and horizontally produced fastigium and the distal dorso-external spine of the caudal tibiae. The size of this spine can not be used, however, to separate *Abila* from *Aristia*, as Stål has done, as in the present genus *mordax* (Stål) and *bicolor*, here described, have it comparatively large, *depressicornis* Bruner has it small, while in *oxycodia* it is minute and, in fact, is absent from one of the caudal tibiae in one of the six specimens before us.

Type.—♂; La Cumbre, Cordillera Occidental, El Valle, Colombia. Elevation, 6600 feet. May 19, 1914. (H. S. Parish.) [Academy of Natural Sciences of Philadelphia, Type no. 5384.]

Size below medium, form medium for the genus. Interocular space distinctly less than twice the width of the proximal antennal joint; depression of vertex indicated only as a transverse sulcus, bounded on each side by a short carina;[128] frontal costa produced, narrow and decidedly sulcate above median ocellus, below indicated only by its weak lateral carinae. Fastigium horizontal, sharply triangular, slightly longer than broad, prominent. Cephalic surface and carinae as in *bicolor*, except that the lateral carinae of the face are more decided, the carinae

[128] Practically obsolete in one male paratype.

delimiting the face weaker. Antennae and maxillary palpi as in *bicolor*. Pronotum and pleura rather strongly rugoso-impresso-punctulate. Pronotal disk with a few weak tubercles and an approximate heavier pair of tubercles at the transverse cephalic margin, caudal margin almost transverse, showing very faint obtuse-angulate production with apex minutely angulate-emarginate; medio-longitudinal carina distinct, weakest between first and second sulci, heaviest between second and principal sulcus, the principal sulcus alone marked; disk flattened between coarse low carinae, which converge from the latero-cephalic angles to meet at the principal sulcus, weakly convex laterad of these, concave on metazona between the median and weak low lateral carinae, the latter showing faint convergence caudad and fading obliquely into the lateral lobes cephalad of the principal sulcus. Prosternal spine erect, elongate. Tegmina represented by linear lateral pads with apices rounded, extending slightly beyond the caudal margin of the median segment and partially concealing the ample tympana. Dorsal surface of abdomen carinate, strongly so proximad and on mesonotum and metanotum. Furcula represented by rounded projections as long as wide, separated by a space slightly less than one-half as wide as interval between the moderately elongate, straight cerci, which taper evenly to their very slender apices. Supra anal plate elongate trigonal, its greatest width two-thirds its length, apex sharply rounded, surface sulcate proximad to an angulate transverse sulcus, beyond this with a blunt tubercle on each side. Subgenital plate very slenderly produced, this portion with dorsal surface deeply sulcate, the very narrow apex rounded. Caudal femora with dorsal carina serrulate and terminating in a minute genicular denticle, other carinae with a few minute serrulations. Caudal tibiae with a very minute distal, dorso-external spine.

Allotype.— ♀ ; same data as type, except taken on May 18, 1914. [Academy of Natural Sciences of Philadelphia.]

Agrees closely with male, differing as follows. Size larger and form more robust. Interocular space nearly twice the width of the proximal antennal joint; depression of vertex with lateral carinae curving a brief distance along its cephalic margin. Fastigium as long as broad. Carinae delimiting face decided. Ovipositor valves moderately heavy, shorter than in *bicolor*, cutting margins unarmed but subcrenulate, apices more strongly curved than in that species.

General coloration of male snuff brown, face light ochraceous-buff, vertex and occiput tawny olive. Genae mummy brown, the sides of the pronotum, abdomen and tegmina with suffusions of this color, the limbs mottled with small flecks o the same. Antennae ochraceous-tawny, darker distad and showing there

traces of annulation. Ventral surface of mesosternum, metasternum and abdomen english red. Ventral surface of median coxae and femora sometimes marked with blackish. Caudal femora ventrad with external portion blackish, internal portion brazil red. Caudal tibiae nopal red, becoming dull proximad.

Female much less contrastingly colored. Varying from mikado brown to verona brown, the caudal femora with external portion of ventral surface dark brown, the caudal tibiae dull reddish.

These brown and somewhat mottled insects probably prefer to live among dead leaves, an environment in which they would be extremely difficult to locate.

The measurements of the type are given first: length of body, ♂, 23, 22 to 23; ♀, 31: length of pronotum, ♂, 4.7, 4.3 to 4.7; ♀, 5.8: caudal width of pronotal disk, ♂, 2.3, 2.2 to 2.4; ♀, 3.2: length of tegmen, ♂, 3.8, 3.3 to 4.2; ♀, 4.8: greatest tegminal width, ♂, 1.3, 1.2 to 1.4; ♀, 1.6: length of caudal femur, ♂, 13.7, 13.2 to 13.3; ♀, 16.3 mm.

In addition to the described pair, there are three male and one large immature female paratypes, bearing otherwise the same data, but taken May 15 to 18, 1914.

Group *Osmiliae*

Abracris obliqua (Thunberg)

1824. *Gr[yllus] obliquus* Thunberg, Mém. Acad. Imp. des Sci. St. Pétersbourg, IX, p. 414. [Brazil.]

Caldas, El Valle, V, 9 to 14, 1914, (H. S. Parish), 3 ♂, 2 ♀, [A. N. S. P.].

Las Mesitas, Cundinamarca, V, 1918, (from A. Maria), 1 ♀.

Rehn has thoroughly studied the synonymy for this insect,[129] apparently the most frequently encountered species of the genus in South America, over which continent it has an extremely extensive distribution. The insect apparently prefers a semi-arid tropical environment. The vicinity of Caldas is arid, the hills "grass-grown with occasional cacti and small acacia-like trees."

Osmilia flavo-lineata (DeGeer)

1773. *Acrydium flavo-lineatum* DeGeer, Mém. Hist. Ins., III, p. 497, pl. 42, fig. 4. [[♀], Surinam (=Dutch Guiana).]

Boca Murindó, Intendencia del Chocó, II, 9, 1918, (M. A. Carriker, Jr.), 2 ♂, 2 ♀.

[129] Trans. Amer. Ent. Soc., XLII, p. 293, (1916).

Andagoya, Antioquia (Chocó), IV, 22, 1918, (M. A. Carriker, Jr.), 3 ♂, 2 ♀.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 3 ♂, 6 ♀.

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, X and XI, 1917, (M. A. Carriker, Jr.), 2 ♂, 1 ♀.

Pueblo Nuevo de Ocaña, Santander, X, 3, 1916, (M. A. Carriker, Jr.), 1 ♀.

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 1 ♂.

Las Mesitas, Cundinamarca, V, 1918, (from A. Maria), 2 ♂, 1 ♀.

Susumuco, Cundinamarca, X, 1917 to 1919, (from A. Maria), 7 ♂, 9 ♀.[130]

Villavicencio, Intendencia del Meta, V, 1917 and XII, 1918, (from A. Maria), 4 ♀.

Cumaral, Intendencia del Meta, VII, 1916, (from A. Maria), 2 ♂, 1 ♀.

These, as well as many Central American specimens, agree fully with a Guianan series of the species before us. In all the wings are weakly tinged with pale dull green-yellow. We are convinced that a single common species occupies all of this territory and that the Panamanian material, recorded by Giglio-Tos as *violacea*, represents instead this insect. We are further of the opinion that *O. tolteca* (Saussure) represents the same species, though that name may prove available for a northern geographic race of *flavo-lineata*.

Group *Nicarchi*

Oulenotacris hesperus new species (Plate XIV, figure 7.)

The unique male before us we believe to be specifically separable from the unique female of *O. robusta* Rehn,[131] from Surinam, by the more declivent and decidedly more transverse fastigium, swollen prosternum with much smaller spine, considerably

[130] A pair recorded by Bruner from "Bogotá," probably came from the vicinity of this locality.

[131] In the author's collection, type no 340. Described, Proc. Acad. Nat. Sci. Phila., 1913, p. 102, figs. 16 and 17. The figures are very poor, giving much too smooth an appearance, with fastigium decidedly more angulate than is the case.

reduced tegmina and wings and not at all strikingly pale ventral portions of pronotal lateral lobes.

Comparison of the same sexes, we feel confident, would show additional differences.

Type.—♂; Susumuco, Cundinamarca, Colombia. Elevation, 2600 feet. April, 1920. (From A. Maria.) [Hebard Collection, Type no. 895.]

Size small, form robust. Interocular space three-quarters width of first antennal joint. Fastigium decidedly declivent (horizontal in *robusta*), distinctly transverse (in *robusta* about as long as wide); ocelli large and visible from above, the fastigial margin forming a broadly convex carina between these (similar in *robusta* but decidedly less carinate). Frontal costa decidedly produced in dorsal portion, so that in lateral aspect decided concavity is shown below; broadening so that between antennae it is slightly wider than proximal antennal joint, the surface in produced portion flattened and moderately impresso-punctate, indicated below median ocellus only by a weak sulcus and blunt lateral carinae. Lateral carinae of face very decided, infra-ocular sulcus broad and deep. Surface of face and genae almost smooth, the face with a short transverse impression on each side of the frontal costa meso-dorsad. Antennae heavy, subensiform proximad, as long as caudal femur excluding genicular portion. Maxillary palpi not enlarged. Pronotum with dorsum flattened but rounding broadly into lateral lobes, shallowly but very coarsely supplied with impressions, two smooth oval areas on each side of disk in prozonal portion; disk with cephalic margin weakly produced and very weakly and broadly emarginate mesad, caudal margin broadly obtuse-angulate with apical portion slightly more produced but apex broadly rounded; transverse sulci decided, the principal sulcus abruptly decided meso-laterad on disk, as in *robusta*;[132] medio-longitudinal carina very weak on metazona, subobsolete on cephalic portion of prozona, absent elsewhere. Prosternum strongly swollen, with a very minute projection meso-caudad. Tegmina and wings moderately reduced but longer than caudal femur; the former with principal veins all longitudinal, apex well rounded and costal margin showing only weak convexity meso-proximad; the latter longer than deep. Furcula represented by a pair of short, bluntly triangular projections, the same margin showing, above the supra-anal plate laterad, on each side, a smaller roughly quadrate projection. Supra-anal plate simple, triangular, slightly shorter than basal width, its lateral margins very

[132] A feature we have not observed in any other genus.

weakly concave in median portion, then convergent to the bluntly rounded apex. Cercus simple, cylindrical, slightly shorter than supra-anal plate. Subgenital plate shallowly scoop-shaped, bearing a very large and bulbous pallium, which occupies a larger area than the supra-anal plate and cerci. Cephalic and median femora moderately heavy. Caudal femora stout, dorsal carina minutely serrulate, minutely angulate produced at apex of genicular area; ventral margins of genicular lobes rather strongly convex, disto-ventral projection rounded. Caudal tibiae well supplied with long hairs, bearing six (but no distal) dorso-external and eight dorso-internal spines. Caudal tarsi with second joint short, about half length of first, third equal in length to first.

General coloration bister, tessellate with darker. Dorsal portion of lateral lobes of pronotum and proximal portion of pleura washed with dull claret brown. Tegmina paler distad with numerous flecks of bister. Wings hyaline, showing only a trace of yellowish proximad, tinged with bister distad and about peripheral margin. Ventral surface and abdomen clay color, the latter blackish proximo-laterad. Cephalic and median limbs warm sepia flecked with black. Caudal femora with three broad transverse bands of liver brown, the median shading to dull claret brown dorsad and meso-laterad, the proximal black in dorso-internal portion, the others very dark on internal surface; internal surface proximad to second band brilliant spectrum red, the other areas between the bands apricot buff externally, paler internally; ventral surface dull purplish, becoming spectrum red distad; genicular areas sayal brown. Caudal tibiae very dull purplish, paler proximad.

Though apparently lacking the pale markings on head, pronotum and pleura (which may possibly have disappeared in drying) and having the wings decidedly less colored, this insect agrees very closely with *robusta* in almost all other color features.

Length of body, 17.6; width across eyes, 4.1; length of pronotum, 4; caudal width of pronotal disk, 3; length of tegmen, 11.8; length of caudal femur, 10.9 mm.

These tropical, mottled, wood-colored grasshoppers are extremely scarce in collections and, like the vine dwelling forms, often show extraordinary structural specialization.

The type of this interesting species is unique.

Group *Ommatolampides*

Ommatolampis perspicillata (Johansson)

1763. [*Gryllus*] *perspicillatus* Johansson, Amoenit. Acad., VI, p. 398. ["Indiis" (in error).]

Susumuco, Cundinamarca, 1 juv. ♂.

The present specimen is in the instar preceding maturity. Comparison with a Guianan series of adults and immatures in the same instar enables us to make the specific determination. It is of particular interest in constituting the most northwestern record for the genus.[133] The locality is situated slightly above the eastern base of the Eastern Andes, in the Orinoco drainage.

Sitalces apolinari new species (Plate XIV, figure 8.)

This handsome insect is one of the largest of the group which includes *S. ovatipennis* Bruner. This group is distinguished from the genotype, *S. volxemi* Stål,[134] by the smaller size, more slender form and striped color pattern of its species. Superficially the forms of this group appear to be very distinct, but we have been unable to find sufficient grounds to separate them from *Sitalces*.

The present species is closely related to *S. nudus* Bruner, described from Santarem, Brazil. It may be separated by its larger size, the presence of seven dorso-external spines on the caudal tibiae and the darker dorsal surface. Males would probably show distinctive genitalic specialization, as is true of a number of the species of this group in the unstudied collections before us.

Type.—♀; Muzo, Boyacá, Colombia. Elevation, 2700 feet. June, 1919. (From A. Maria.) [Hebard Collection, Type no. 892.]

Size approximating that of genotype, form decidedly more slender. Interocular space very narrow, scarcely over half width of proximal antennal joint. Fastigium small, rounded triangular, feebly declivent but forming a distinct though rounded angle with frontal costa; the latter produced in dorsal portion to median ocellus, twice the interocular width, with surface flattened, below median ocellus indicated only by a weak sulcus, which disappears before reaching the clypeal suture. Lateral carinae of face low but heavy, as are the infra-ocular sulci. Pronotum subcylindrical, with medio-longitudinal carina distinct only on metazona, transverse sulci decided, particularly

[133] We have noted under *Taeniophora* that two Colombian species, described as members of the genus *Ommatolampis* by Gerstaecker, must be referred to that genus.

[134] A female, determined and recorded by Rehn, from Petropolis, Brazil, is in the Academy Collection.

on lateral lobes; lateral portions of caudal margin very feebly convex, forming a weak median emargination meso dorsad; surface smooth, except ventrad on lateral lobes, where it is feebly wrinkled and on metazona, which is thick'y impresso-punctate. Tegmina, wings and tympana absent. Prosternum feebly swollen, with a minute point projecting mesad Abdomen with a medio-longitudinal carina. Ovipositor valves large, the dorso-external margins coarsely toothed, the dorsal apices moderately curved, the ventral apices more strongly curved. Caudal femora (as characteristic of genus) with margins smooth, apex of dorsal carina minutely triangularly produced and ventral margins of genicular lobes rather strongly convex. Caudal tibiae armed with seven dorso-external (but no distal) spines. Distal joint of caudal tarsi equal to combined length of first and second joints.

General coloration of occiput and postocular portion of genae, pronotum, mesonotum, metanotum and pleura, proximal portion of abdomen and all of genicular areas of caudal femora shining blackish brown, marked with buffy yellow as follows: two spots between occiput and genae; an oblique band in ventral portion of genae continued on pronotum as a broad longitudinal band just within the ventral margin of the lateral lobes and appearing as flecks on the pleura; the pronotum and abdomen proximad with a linear medio-longitudinal and broader lateral bands, these latter absent on pronotum between the first and second sulci and appearing as large spots on the other segments. Face, ventral surface and remaining portions of abdomen greenish yellow. Antennae reddish brown. Cephalic and median limbs and caudal femora (excpt the genicular areas) yellowish green. Caudal t.biae and tarsi dark bluish glaucous.

The measurements of the type are given first. Length of body, 19.3 and 19.7; length of pronotum, 3.7 and 3.8; total caudal width of pronotum, 4 and 4.2; length of caudal femur, 11.2 and 11.4 mm.

In addition to the type, a single paratypic female is before us, taken at Villavicencio, Intendencia del Meta, during July, 1918, and sent us by Hermano A. Maria.

PSILOSCIRTUS Bruner

1911. *Psiloscirtus* Bruner, Ann. Carnegie Mus., VIII, p. 141.

Bruner originally included the single species *olivaceus*,[135] from Benevides, Pará, Brazil. To *Psiloscirtus* also belongs

[135] Rehn's *Sitalces jugatus*, described from Pará, Brazil, is a synonym of *olivaceus*.

apterus (Scudder),[136] from the Peruvian Andes and *debilis* (Rehn),[137] from Rosario, Ecuador.

We do not agree with Bruner in considering the genus nearest *Rhachicreagra*. The fastigium forms a distinct, though rounded angle with the frontal costa and comparison shows close affinity to *Sitalces*. From that genus *Psiloscirtus* is best separated by the serrate and denticulate carinae of the caudal femora and the antler-like male cerci.

Psiloscirtus splendidus new species (Plate XV, figures 17 and 18; plate XVI, figure 1.)

The very brilliant coloration of the median segment and dorsal surface of the abdomen readily distinguishes this species. It is related to *P. apterus* (Scudder), differing in the broader, blunter vertex, impresso-punctate pronotum and succeeding tergites, more triangularly toothed ventral carina of caudal femora, coloration, and male cerci which, though of the same type, show decided differences of proportion.

Type.—♂; Susumuco, Cundinamarca, Colombia. Elevation, 2600 feet. April, 1920. (From A. Maria.) [Hebard Collection, Type no. 893.]

Size and form medium for the genus. Interocular space slightly over half width of proximal antennal joint. Vertex with a linear medio-longitudinal sulcation; fastigium weakly declivent, twice as broad as long, its apex broadly truncate. Frontal costa produced as far as median ocellus, the width of this portion nearly one and one-half times width of proximal antennal joint, its surface weakly angulate-impressed and with a few impressed punctulae; below median ocellus moderately distinct and sulcate. Face impresso-punctate, its lateral carinae prominent, the infra-ocular sulcus broad but decided. Pronotum impresso-punctate, medio-longitudinal carina distinct only cephalad and on metazona; cephalic and caudal margins of disk transverse, each with emargination faintly indicated mesad. Prosternum swollen, with a small erect spine mesad. Tegmina and wings absent. Tympanum large. Abdomen with a weak medio-longitudinal carina which disappears distad, distal portion moderately clavate. Furcula represented by two minute points Supra-anal plate elongate shield-shaped, surface medio-longitudinally broadly and shallowly sulcate

[136] Described as an *Ommatolampis*.

[137] Described as a *Sitalces*.

proximad and distad, more deeply concave laterad, but with portion at bases of cerci convex. Cerci broadly vertical, tapering feebly in proximal portion, then with ventral half suddenly truncate, thereby this portion terminating in a distal tooth; the dorsal half tapering and directed inward toward apex of supra-anal plate, with a heavy median tooth on ventral margin, thence tapering to the sharply rounded apex. Cephalic and median femora very heavy. Caudal femora with dorsal carina serrulate proximad, terminating in a weakly triangular genicular projection; ventral carina serrulate proximad, these serrulations increasing in size distad to form several long, dentiform projections, which are much heavier than in *olivaceus* or *apterus*; sulcations of external pagina showing impressed punctae; ventral margins of genicular area strongly convex, as is usual in this genus and *Sitalces*. Number of dorso-external spines of caudal tibiae variable (six to nine in series). Last joint of caudal tarsi equal to combined length of first two joints.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

This sex is generally similar to the male, but differs in the following respects. Size much larger, form heavier and distinctly more fusiform. Interocular space three-quarters width of proximal antennal joint. Fastigium less than twice as broad as long. Frontal costa in produced portion obscurely sulcate, its surface impresso-punctulate; carinae and sulci of face more decided. Carinae and sulci of pronotum weaker, the former stronger on the other tergites. Ovipositor valves large, the dorso-external margins obscurely toothed, the apices moderately curved, the ventral pair the more strongly. Cephalic and median femora decidedly more slender. Caudal femora with dorsal carina subserrulate proximad, ventral carina with a few blunt serrulations distad.

Male occiput, postocular portion of genae, pronotum, mesonotum, metanotum and pleura, except lower portions, olivaceous black, the mesonotum and metanotum slightly paler mesad. Eyes auburn with a coppery luster. Vertex buffy. Antennae stone green, becoming blackish distad. Frontal costa, face, lower portions of genae, pronotal lateral lobes and pleura, cephalic and median femora and ventral surface colonial buff with a greenish tinge, the dorsal margin of this marking on the sides of the body convex dorsad. Cephalic and median tibiae and tarsi, caudal tarsi and apex of abdomen lumiere green. Caudal femora lumiere green, deepening distad, with genicular areas forest green, the genicular arches black. Caudal tibiae bluish gray green, the spines paler with distal half black. Median segment brilliant nopal red becoming dull mesad, its lateral margins broadly and caudal margin very narrowly black; succeeding tergites grenadine pink dorsad, black laterad, the

latter marking rapidly narrowing and disappearing, the sides of the abdomen thence yellowish. Furcula blackish, supra-anal plate dull green-yellow, cerci bice green.

Female showing the same general pattern but less brilliantly colored. Corresponding portions of head, pronotum, mesonotum, mesanotum and pleura, but also proximal portion of median and all of the other abdominal tergites deep prouts brown, the abdomen becoming greenish distad and proximal tergites blackish brown laterad. Caudal portion of median segment dull mars orange, this narrow mesad, the caudal margin black. Vertex tawny olive. Areas which are colonial buff with a greenish tinge in the male, are the same in this sex. In the Susumuco female the pale areas are more greenish, the caudal femora tinged with darker green.

The measurements of the allotype are given first for the female sex. Length of body, ♂, 17.5; ♀ 23.3 and 22.8: length of pronotum, ♂, 4; ♀ 4.4 and 4.3: total caudal width of pronotum, ♂, 3.7; ♀, 5 and 5: median width of body, ♂, 4.1; ♀, 6.1 and 6.3: length of caudal femur, ♂, 11; ♀, 13.8 and 13.2 mm.

In addition to the described pair, a female paratype from Villavicencio, Intendencia del Meta, taken in May, 1917, and from A. Maria, as well as a dried alcoholic male from the State of Cundinamarca, belonging to the Museum of Comparative Zoology, are before us.

This is one of the handsomest Colombian grasshoppers. The contour of the species of this genus somewhat suggests certain of the apterous Melanopli.

Group *Cyrtacanthacres*

SCHISTOCERCA Stål

Eight Colombian species of the large and difficult genus *Schistocerca* are here discussed. Scudder's revision of this genus, in 1899, has probably hindered rather than aided scientific progress. This is due partly to the superficial character of the work and partly to the fact that, in many cases, dried alcoholic material was studied. Color pattern is a most important factor in distinguishing not only the species, but even the groups, of this genus. Alcoholic specimens are usually not only distorted, but also frequently have the color pattern blurred or completely destroyed. Description of new species of *Schistocerca* from such material should, therefore, never be attempted.

Schistocerca bogotensis Scudder

1899 *Schistocerca bogotensis* Scudder, Proc. Amer. Acad. Arts. and Sci., XXXIV, p. 460. [♀; Bogotá, Colombia.]

Bogotá, Cundinamarca, IV, 1917,[138] (from A. Maria), 11 ♂, 27 ♀, 1 juv. ♀.

Choachi, Cundinamarca, 1916, II, 1915 and XI, 1918, (from A. Maria), 2 ♂, 6 ♀.

This is an obscurely colored insect, showing agreement with the Ecuadorean *S. subvittata* (Walker)[139] in more features than with any other previously known species.

Though described from a female showing a medio-longitudinal dorsal band, only a single female in the present series shows this distinctly, other specimens having the vertex and median portion of the occiput faintly paler, but the majority have the head and pronotum unicolorous.

The most important features in distinguishing this species are, we believe, as follows. Head and pronotum (normally) virtually immaculate, the latter bluntly obtuse-angulate caudad. Antennae elongate. Prosternal spine elongate but blunt. Tegmina without a marginal stripe, usually unicolorous except for small obscure darker blotches distad in the discoidal field, but in intensive specimens with numerous large vague darker blotches in that field. Wings hyaline, faintly tinged with yellowish proximad and faintly brownish elsewhere, with veins brown. Caudal femora with dorsal margin serrulate, the external pagina with each section whitish. Caudal tibiae dark vinaceous[140] with black-tipped spines paler and brighter (jasper pink).

The following measurements give the extremes for the present series. Length of body, ♂, 30.4 to 33.8; ♀ 45.8 to 50: length of pronotum, ♂, 6 to 6.9; ♀, 9.8 to 10.8: caudal width of pronotal disk, ♂, 3.8 to 4.5; ♀, 6.4 to 7.7: length of tegmen, ♂, 31.8 to 35.2; ♂, 45.7 to 49.5: length of caudal femur, ♂, 17.4 to 19.7; ♀, 25.8 to 28.8 mm.

[138] The majority of this series are without date.

[139] Material of *subvittata* is represented in the unstudied Ecuadorean collections before us.

[140] In some specimens more brilliant, individually varying from pompeian red to hessian brown.

Schistocerca boyacae new species (Plate XIV, figure 9.)

This is also an obscurely colored insect, belonging to the same group as *S. bogotensis* Scudder. Comparison of females shows *boyacae* to differ in being larger but less robust, the head with a narrow and nearly vertical suffused blackish line, the tegmina immaculate but with anal fields distinctly paler than the other portions, the wings decidedly more strongly tinged with yellow but less infuscated distad.

Agreement with the Mexican *S. vitticeps* (Walker)[141] is shown by the almost identical coloration of the dorsal surface of head and pronotum, that species differing in the lateral markings of these portions, as well as in numerous other respects.

Ecuadorean females of *E. subvittata* (Walker)[142] before us, show complete agreement in size and coloration of head and caudal femora. They differ in being more robust, with pronotum unicolorous, tegmina as in *bogotensis*, wings less tinged with yellow proximad and heavily suffused with brown distad, caudal tibiae reddish brown with spines buffy and black tipped, those of the internal margin being more strikingly longer than those of the external margin.

It is clear that *subvittata*, *bogotensis* and *boyacae* belong to the same group. It is indeed possible, though in our opinion not likely, that more thorough knowledge of these insects may show that they represent geographic races of a single species.

Type.— ♀ ; Muzo, Boyacá, Colombia. Elevation, 2700 feet. (From A. Maria.) [Hebard Collection, Type no. 896.]

Size moderately large, form rather slender for the genus. Interspace between eyes one and one-quarter times width of frontal costa between antennae; fastigium weakly transverse, flattened, weakly declivent; frontal costa widening very faintly from vertex to clypeus, its surface above median ocellus very weakly convex and very minutely impresso-punctulate, below broadly and deeply sulcate. Antennae well exceeding combined length of head and pronotum. Pronotum with lateral

[141] Of which species, as Kirby has correctly noted, *S. pyramidata* Scudder is a synonym.

[142] This species was described from Guayaquil, Ecuador and Demerara, British Guiana. We here select the former as type locality. We believe that the Guianan material represents *S. flavofasciata* (DeGeer), very dusky and suffused specimens of which species are before us from the Guianas.

margins of disk distinct only on metanotum, there broadly rounded; disk moderately convex cephalad, flattening caudad, median carina distinct, strongest on metazona, transverse sulci distinct and clean cut, prozona distinctly shorter than metazona; caudal margin of disk rectangulate but with apex very broadly rounded. Tegmina and wings elongate, extending beyond apex of abdomen, the former comparatively broad. Prosternal spine cylindrical, elongate, with apex bluntly rounded. Interspace between mesosternal lobes slightly widest cephalad. Ovipositor valves elongate and heavy, their apices strongly curved. Caudal femora moderately stout, distinctly less heavy than in *subvittata*. Caudal tibiae with (ten to eleven) internal spines longer than (seven to ten) external, this difference by no means as decided as in *subvittata*.

General coloration sayal brown, tinged with bister proximad in discoidal field of tegmina. Head and pronotum with a broad medio-longitudinal band of cinnamon, which disappears on the metazona, this band margined with a narrow blackish suffusion on occiput. Subocular portion of genae with a suffused blackish line, running from ventro-caudal angle to base of eye. Pronotum immaculate except for the dorsal band. Anal field of tegmina dull ochraceous-buff, other portions almost uniform sayal brown, very slightly darker proximad in discoidal field. Wings hyaline tinged with citron yellow, this strong proximad, veins of radiate field distad and of anterior field brown, the apex of the wings tinged with brown. Caudal femora with all sections of external paginae whitish, a series of minute whitish flecks on internal portion of dorsal surface and a few of the same proximad on external portion of dorsal surface, arches of genicular areas and a narrow continuation to ventral margin proximad dark brown. Caudal tibiae madder brown, the spines jasper red, black tipped.

In the slightly more intensive paratype, the dorsal margins of the external pagina of the caudal femora show a few black dots.

The measurements of the type are given first. Length of body, 52.5[143] and 53.3; length of pronotum, 11 and 11; length of metanotum, 6.1 and 6.1; caudal width of pronotal disk, 7 and 7; length of tegmen, 53.7 and 52.2; greatest tegminal width, 9.1 and 9; length of caudal femur, 28.1 and 28 mm.

In addition to the type, a single paratypic female, bearing the same data, but taken in September, 1919, has been studied.

Schistocerca diversipes new species (Plate XIV, figures 10 and 11; plate XV, figure 19.)

This species, of the zone below the Paramos of the Sierra Nevada de Santa Marta, is of particular interest in that it is

[143] Estimated.

the first of the genus known from these uplands or those of the Andean system and has, in the female sex, apparently as a normal condition, distinctively marked and brilliantly colored caudal tibiae, of a type unknown for any other form.

We place the species in the Flavofasciata Group. It is shorter and stockier than any other species which we recognize as belonging there. To *S. desiliens* (Scudder)[144] nearest affinity appears to exist, the present insect differing further in the more inflated prozonal portion of the pronotum, decidedly broader angulation of its caudal margin, the female sex with tegmina showing an average heavier maculation, the pallid band proximad on the costal margin[145] showing more numerous dark flecks and the much deeper pink of the distinctively marked caudal tibiae. In males of *diversipes* the cerci do not taper distad.

Type.—♀; Macotama Valley above San Miguel, Sierra Nevada de Santa Marta, Magdalena, Colombia. Elevation, 7000 to 8000 feet. April 3, 1914. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 896.]

Size rather small and form robust for the genus. Interspace between eyes slightly more than one and one-quarter times width of frontal costa between antennae; fastigium weakly transverse, flattened, weakly declivent. Antennae and pronotum much as described for *S. boyacae* on page 275, the latter differing in the moderately inflated prozona, the medio-longitudinal carina decided but weakening cephalad and caudad, the caudal margin of the disk faintly more obtuse angulate and the entire surface thickly and rather decidedly rugoso-impresso-punctulate, rougher than in that species. Tegmina and wings comparatively short, extending a brief distance beyond apex of abdomen, the former of normal width. Prosternal spine elongate, inflated,[146] with apex bluntly rounded. Interspace between mesosternal lobes widening rather strongly cephalad. Ovipositor valves moderately elongate, heavy, their apices strongly curved. Caudal femora comparatively short and stout, quite as heavy as in *desiliens*. Caudal tibiae with (ten to eleven) internal spines longer than (eight) external, this difference not as great as in *desiliens*, much as in *boyacae*.

[144] Our comparisons are made with Brazilian material of *desiliens*, recorded by Rehn and in the Academy Collection.

[145] In both species this band is almost obliterated in occasional individuals.

[146] Less so in some paratypes than in others and in one comparatively slender.

Allotype.—♂; Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Colombia. Elevation, 6500 feet. April 25, 1914. (M. A. Carriker, Jr.) [Hebard Collection.]

Agrees with female except as follows. Size much smaller, form less robust. Interocular space narrower, vertex decidedly longer in proportion to width. Pronotum with prozona slightly more inflated, caudal margin of disk rectangularly produced but with apex as bluntly rounded. Cerci lamellate as characteristic of the genus, not tapering to the weakly oblique apex, with distal angles rounded. Subgenital plate much as in *flavofasciata*, the meso-distal emargination narrow and moderately deep.

General coloration of female cinnamon brown, suffused and maculate with deep bister. Head and pronotum with a broad medio-longitudinal band of hazel, which disappears on the metazona (very weak on pronotum in type), this band margined with a blackish suffusion on occiput. Head elsewhere flecked with blackish bister, with a very narrowly V-shaped vertical sub-ocular suffusion of the same. Pronotum with disk in prozonal portion suffused laterad with blackish bister and with flecks of the same on metazonal portion, somewhat heavy streaks of blackish bister at the caudal margin of the lateral lobes; lateral lobes with a broad and oblique band of blackish bister mesad in the prozonal portion, its margin suffused dorsad but sharply delimited ventrad by the large cinnamon-buff oblique pale area which occupies the ventro-cephalic portion. Tegmina avellaneous, anal field with flecks of blackish bister proximad; discoidal field very heavily maculate with blackish bister, which weakens distad but with maculae so numerous that only small patches of the paler ground color remain; mediastine field with an irregular longitudinal band of the paler coloration proximad, elsewhere suffused with bister and with flecks of blackish bister even in the distal portion of the pale band. Wings hyaline, transparent, tinged with chartreuse yellow proximad, veins and veinlets distad bister. Cephalic and median femora of the general coloration, usually flecked with blackish bister. Caudal femora with sections of external pagina whitish but washed with slate in dorsal portion and there often flecked with blackish bister, its margins with heavy flecks of the same; elsewhere these members are of the general coloration with numerous flecks of blackish bister, except ventral surface, which is violet black. The latter surface varies individually, however, in some being deep gray, in others buffy proximad shading to gray distad. Caudal tibiae and tarsi rose red, the former thickly spotted with black, the spines and spurs rose red, black at bases and apices. One female has these portions darker, bordeaux, immaculate but with spines and spurs the same.

The males are similar but much less mottled, the dark median area on the lateral lobes of the pronotum less conspicuous, the tegmina weakly mottled, with pale mediastine streak narrower and less conspicuous. The caudal tibiae are immaculate, bordeaux, with spines and spurs rose red, black at bases and apices. One, however, has the caudal tibiae still darker, blackish burnt lake, in strong contrast to the spines and spurs which are of the usual shade.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Length of metanotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Macotama, *paratype*	28.3	5.3	2.9	3.9	26	15.3
Macotama, *paratype*	32	6.7	3.3	4.3	31.3	19
Taquina, *allotype*	34	7	3.8	4.4	31.7	20
♀						
San Miguel, *type*	48	9.7	5	6.7	43	24.5
San Miguel *paratype*	45.5	9	4.9	6.9	42	24.3
San Lorenzo, *paratype*	46	9.7	4.8	7	42	26
San Lorenzo, *paratype*	47.7	9.7	4.9	7	45	26.4

Specimens Examined: 7; 3 males and 4 females.

Paramo de Macotama, Sierra Nevada de Santa Marta, Magdalena, 10,000 feet, IV, 10, 1914, (M. A. Carriker, Jr.), 2 ♂, *paratypes.*

Macotama Valley above San Miguel, Sierra Nevada de Santa Marta, Magdalena, 7000 to 8000 feet, IV, 3, 1914, (M. A. Carriker, Jr.), 2 ♀, *type* and *paratype.*

Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, 6500 feet, IV, 25, 1914, (M. A. Carriker, Jr.), 1 ♂, *allotype.*

Sierra San Lorenzo, Magdalena, 8300 feet, VIII, 23, 1913, (M. A. Carriker, Jr.), 2 ♀, *paratypes.*

Schistocerca gratissima Rehn

1908. *Schistocerca gratissima* Rehn, Proc. Acad. Nat. Sci. Phila., 1908, p. 20, figs. 4 and 5. [♂: Sao Paulo, Brazil; Surinam (=Dutch Guiana).]

1911. *Schistocerca formosa* Bruner, Ann. Carnegie Mus., VIII, p. 127. [♂, ♀; Cacagualito, Magdalena, Colombia.]

Except for the fact that Bruner's material showed a negligible size difference, no reason was either offered or available for proposing the name *formosa*, an absolute synonym of *gratissima*. Rehn's description of *gratissima* is full, accompanied by accurate measurements and excellent figures. Nearest relationship is with *S. viridescens* (Walker), discussed below.

Knowledge of the distribution of *gratissima* is augmented by two males, in the Academy Collection, taken at Maripa, Rio Caura, Venezuela, October, 1909, by M. A. Carriker, Jr. The only color difference in this series is shown by the slightly more intensive Surinam male, which has the face solidly green, the others having the interval between the frontal costa and lateral carinae pinkish brown.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotal disk	Length of tegmen	Length of caudal femur
Cacagualito, Colombia[147]	52	10.5	—	49	26
Maripa, Venezuela	44.5	9.7	5.7	41.7	24.6
Surinam	42.2	8	5.2	38.8	20.2
Sao Paulo, Brazil, *paratype*	45	8.3	5.8	37.5	22
Sao Paulo, Brazil, *type*	49.5	9.5	6	46.7	25
♀					
Cacagualito, Colombia[147]	69	13	—	63	36

Schistocerca viridescens (Walker)

1870. *Cyrtacanthacris viridescens* Walker, Cat. Dermapt. Saltat. British Mus., III, p. 553. [♀, Brazil.]

1908. *Schistocerca vittafrons* Bruner, Biol. Centr.-Amer., Orth., II, p. 298. [♂, ♀; Boruca, Costa Rica.]

Comparison of the type series of *vittafrons* and a large number of specimens from Venezuela and Trinidad with the original description of *viridescens* gives convincing evidence of the above synonymy. In many Venezuelan examples and one Costa Rican female the dark subocular marking and patch on the lateral lobes of the pronotum is deep green. In the others these markings are blackish brown.

This is a very handsome, trim species, which occupies a position almost intermediate between *S. gratissima* Rehn and *S. pallens* (Thunberg). We have discussed this insect as, from its known distribution, it will almost certainly be found in Colombia.

[147] According to Bruner.

Schistocerca pallens (Thunberg)

1815 *G[ryllus] pallens* Thunberg, Mém. Acad. Imp. des Sci. St. Pétersbourg, v, p. 237. [No locality stated, (given as Jamaica by Kirby).]

Cauca, IV, 1920, (from A. Maria.), 1 ♂, 1 ♀.

The range of this species has been defined by Rehn as "from eastern Mexico and the Greater Antilles, south to the Uruguay River and northern Argentina, east to Natal, Brazil and west in South America to the eastern slopes of the Andes in Peru."

The insect is exceedingly variable, recession of color pattern causing the tegmina to become immaculate except for elongate suffusions of dark brown, this being apparently the usual condition in Mexico and the Greater Antilles.

The material here recorded, and all before us from the Lesser Antilles, is decidedly darker, with discoidal field of the tegmina filled with suffused patches of dark brown, while the Cauca male and one from Martinique have the dark median patch of the pronotal lateral lobes lacking a narrow, pale medio-longitudinal line.

Brazilian and Peruvian material shows the maximum of intensive coloration, being very dark, the lateral lobes of the pronotum almost solidly dark except for the pale area ventrad, the dorsal margin of which is weakly oblique, as characteristic of the present species.

Though more slender and usually more contrastingly colored, with markings more sharply defined, occasional individuals of *S. viridescens* (Walker), in which the dark subocular and lateral pronotal markings are brown, show very close convergence toward the condition normal for *pallens* in the Lesser Antilles.

Schistocerca paranensis (Burmeister)

1861. *Acridium paranense* Burmeister, Reise durch La Plata Staaten, I, p. 491. [La Plata region and Province of Entrerios, [Argentina]; Paraná.]
1879. *Acridium patianum* Posada-Arango, Le Naturaliste, I, no. 2, p. 4. [♂, ♀; Medellin,[148] [Antioquia,] Colombia.]
1918. *Schistocerca urichi* Arribalzaga, Physis, IV, no. 16, p. 64, figs. 4 and 5, p. 65, fig. 2. [♂, ♀; Port of Spain, Trinidad.]

The very excellent discussion by Arribalzaga, in 1918, furnishes one of the most detailed accounts of the structure, life history,

[148] There are specimens from this locality in the Academy Collection, recorded as *paranensis* by Rehn, in 1913.

habits and distribution of this migratory and devastating insect. That author, unfortunately, chose to consider the northern type distinct from the southern, due to "the more inflated cheeks, proportionately shorter organs of flight and more intense tegminal spots." In considering a very large series from both regions, we find that the inflation of the cheeks is not constant, but that the organs of flight do show an average greater development in the southern insect, which also has the tegminal spots normally weaker. These differences are, however, by no means sufficient, in our opinion, to warrant the recognition of even racial differentiation. This conclusion is further supported by the fact that immature individuals from northern and southern America before us are indistinguishable. As a result we place *urichi* in the present synonymy.[149]

We further find that, though the dorsal surface of the caudal tibiae is pink only in occasional South American specimens, this is the normal condition in Costa Rica and that the pink is very deep in some individuals from that country. It is evident, however, that this again is not a constant feature and such material can not be given nominal recognition.

Arribalzaga is again in error in supposing the destructive migratory species of Mexico to be *S. americana* (Drury). The specimens from Honduras recorded by Rehn as *americana*,[150] represent *paranensis*, as does a female before us from Guatemala and a large series from Costa Rica. It is clear that the insect, which at times creates havoc in southern Mexico,[151] is *paranensis*, migrating northward from areas of permanent habitat in Central America.

This is certainly the species described as *Acridium patianum* by Posada-Arango, who compared it with *Acridium peregrinum*

[149] Mr. James A. G. Rehn, having considered the data and compared the series before us, concurs throughout in the present findings. Even if the northern type were distinct, *urichi* would fall as a synonym of *patianum*.

[150] Trans. Amer. Ent. Soc., XXIX, p. 15, (1902).

[151] Segura has published a large report on the outbreak of this insect in Mexico, identifying it as *Acridium peregrinum*. Informe que la Comision para el Estudio de los Medios mas Adecuados para la Destruction de la Langusta, rinde a la Secretaria de Fomento, pp. 1–184, (1883).

(=*S. tatarica* (L.)), a migratory species of the Old World.[152]

Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, 6500 feet, IV, 25, 1914, (M. A. Carriker, Jr.), 4 ♂.

Sierra San Lorenzo, Magdalena, 8300 feet, VIII, 23, 1913, (M. A. Carriker, Jr.), 2 ♂.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, 4000 to 5000 feet, VII, 1913, (M. A. Carriker, Jr.), 1 ♀.

Bogotá, Cundinamarca, (from A. Maria), 3 ♀.

Cali, El Valle, V, 24 and 29, 1914, (H. S. Parish), 2 ♂, 1 ♀, [A. N. S. P.].

Colombia, (from A. Maria), 16 juv.

During periods of migration the species has occurred over all of northern South America. At other times it apparently is not to be found over the greater portion of Colombia. Posada-Arango tells us that an area of permanent habitat is located in the arid valley of the Patia, in the southwestern state of Naraño. It is probable that such areas reach their greatest extent about the juncture of Bolivia, Paraguay and the Argentine Republic.

The present insect shows quite a strong resemblance to the Old World *S. tatarica* (Linnaeus). That species differs in having a proportionately shorter pronotum, with prozonal portion more strangulate, transverse sulci more decided and metazonal portion decidedly more flaring, broader and weakly inflated.

In summing up our conclusions we find that *paranensis* is a species which, during periods of migration, has devastated large portions of the American continent, from Argentina as far north as southern Mexico. It is probably present at all times over extensive portions of Argentina and Venezuela and over more limited areas elsewhere, such areas occurring in Colombia and Costa Rica. It has been frequently recorded as *peregrina*, a distinct but easily confused species of the Old World; as *americana*, a North American species to which individuals of *paranensis* of unusually brilliant and contrasting coloration

[152] No specimens of *peregrinum* from the New World are before us. Ecuadorean material so recorded by Giglio-Tos represents *paranensis*, as does, almost certainly, the material recorded by him from Panama as that species. It is probable that almost all the records of *peregrinum* from the New World are based on misidentified material of *paranensis*.

show a very close superficial resemblance, and probably as other related or poorly described species of the genus. While it is true that other species, representing this and other genera, are at times migratory and destructive in the New World, the ravages of *paranensis* have probably covered far more territory and resulted in greater devastation than those of all the others combined.

Schistocerca separata Scudder

1899. *Schistocerca separata* Scudder, Proc. Amer. Acad. Arts and Sci., XXXIV, p. 469. [♂, ♀: Chontales, Nicaragua; Costa Rica.]

1905. *Schistocerca malachitica* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 439, figs. 34 and 35. [♀; Turrialba, Costa Rica.]

Comparison of a rather large unrecorded Costa Rican series of this insect convinces us as to the above synonymy, suggested by Bruner in 1908. In the Costa Rican paratype of *separata*, in the author's collection, the medio-longitudinal dorsal stripe, due to discoloration, disappears on the metazona. Such is probably also true for the Nicaraguan material. It was evidently this feature which led Rehn to describe *malachitica*, based on a specimen showing no discoloration.

El Tambo, Intendencia del Chocó, IV, 5, 1918, (M. A. Carriker, Jr.), 1 ♂.

Buenaventura, El Valle, V, 7 and 8, 1914, (H. S. Parish), 3 ♂, 4 ♀, [A. N. S. P.].

In the present series two males and two females have the broad, percurrent, medio-longitudinal dorsal stripe light yellowish-bronze. This stripe is normally green in Central American material.

Group *Melanopli*

TRIGONOPHYMUS Stål

We feel obliged to follow Kirby in the use of this name, at least for the species *punctulatus*, which species has been repeatedly referred to the genus *Dichroplus* in past literature. Stål, comparing the types of *Gryllus fuscus* Thunberg (genotype of *Trigonophymus*)[153] and *Gryllus punctulatus* Thunberg, has stated that these species were scarcely distinguishable. Should *Podisma arrogans* Stål[154] prove generically distinct from *fuscus*,

[153] Indicated by Kirby in 1910.

[154] Selected as genotype of *Dichroplus* by Rehn in 1907.

the generic name *Dichroplus* would be available for that species and its congeners, otherwise *Dichroplus* will fall in synonymy under *Trigonophymus*, the latter name having page priority.

Trigonophymus punctulatus (Thunberg)

1824. *Gr[yllus] punctulatus* Thunberg, Mém. Acad. Imp. des Sci. St. Pétersbourg, IX, p. 408. [Brazil.]

1905. *Dichroplus morosus* Rehn, Proc. Acad. Nat. Sci. Phila., 1905, p. 442. [♀; Monte Redondo, Costa Rica.]

Comparison of the type of *morosus*, and other Costa Rican specimens so recorded by Rehn, with the present material and large series from Brazil, Paraguay and the Argentine, proves beyond question that but a single species is represented.

Paramo de Cerros de Caracas, Sierra Nevada de Santa Marta, Magdalena, 11000 to 12000 feet, VI, 5, 1914, (M. A. Carriker, Jr.), 9 ♂, 5 ♀.

Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, 6500 feet, IV, 25, 1914, (M. A. Carriker, Jr.), 4 ♂, 2 ♀.

Sierra San Lorenzo, Magdalena, VIII, 23, 1913, (M. A. Carriker, Jr.), 4 ♂, 3 ♀.

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 7 ♂, 8 ♀.

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, XI, 1917, (M. A. Carriker, Jr.), 8 ♂, 11 ♀.

Cauca, 1 ♂, [A. N. S. P.].

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 2 ♀.

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 1 ♀.

Palmar, Rio Casenare, Boyacá, IV, 1917, (M. A. Carriker, Jr.), 1 ♀.

La Cumbre, Cordillera Occidental, El Valle, V, 19, 1914, (H. S. Parish), 1 ♂, 1 ♀, [A. N. S. P.].

Caldas, El Valle, V, 1914, (H. S. Parish), 1 ♀, [A. N. S. P.].

Difference in altitude appears to have but little influence, individuals from the higher elevations showing only an average slight reduction in the length of the tegmina and wings.

A striking color phase is occasionally developed in females, shown by four of the present series, in which the pronotal disk

proximad and caudad in large triangular areas and the large interval dorsad between the first and second dark areas on the caudal femora are very pale, buffy. All of these individuals are elsewhere very dark.

CHIBCHACRIS new genus

This interesting genus is closely related to *Chlorus* Giglio-Tos,[155] and includes not only the three new species described below but also the Colombian *Pezotettix varicolor* Stal.[156]

Genotype.—Chibchacris furcata new species.

From *Chlorus* it may be distinguished by the pronotum with caudal margin very weakly convex, the female having the dorsum flattened and expanding strongly caudad,[157] the tegmina likewise shorter than the pronotum, roughly broad oval but overlapping and with discoidal field in a distinctly different plane from that of the marginal field, the apex lying entirely in the former field and the distal margin showing a distinct though obtuse-angulate emargination at the juncture of these fields.[158] In males, furcula are absent or very minute (in *casenare* alone); the supra-anal plate is triangular with lateral margins weakly convex, and the cerci are slender and distad directed upward and inward, with a tooth ventro-distad at the end of the heavier proximal portion.

In both *Chlorus* and *Chibchacris* the general facies is characteristically Melanoploid. These genera agree in having the fastigium blunt, moderately declivent and briefly produced, with surface feebly concave. Frontal costa narrowest dorsad with surface weakly concave to deplanate and lateral aspect straight. Pronotum smooth, with transverse sulci very fine but distinct and medio-longitudinal carina present only on the narrow metazona. Prosternal spine well developed, slenderly conical. Cephalic and median femora of males weakly curved but decidedly inflated. Free margin of male subgenital plate not abruptly ampliate proximad. Ovipositor of females normal.

[155] Bruner's *Eurotettix* is possibly a synonym of *Chlorus*.

[156] The species has subsequently been assigned to *Paradichroplus* (= *Pedies*).

[157] Except in *C. casenare*, which species is aberrant in this feature.

[158] The tegmina, in *Chibchacris*, conceal linear vestigial wings and a large tympanum.

Chibchacris casenare new species (Plate XVI, figures 2, 3 and 4.)

Very close relationship to *C. varicolor* (Stål) is evident, these being the smallest known of the genus, of which *casenare* apparently averages slightly the larger. From that insect males of *casenare* differ in having the more slender distal portion of the cerci occupying distinctly less than half the cercal length, the subgenital plate, also, can not be said to be "triangularly produced." The males have the cephalic and median femora largely, and the entire external face of the caudal femora, green. The females before us show the color phases described by Stål for *varicolor* as "Var. a and b," his "var. c" apparently being based on males.

The present insect differs from the other species here described in having the ventral portion of the pronotal lateral lobes pale in the male, the pronotal disk decidedly less widened caudad in the female. The male with very minute but distinguishable furcula, cerci with shorter and tapering apical portion and well rounded, conical subgenital plate.

Type.—♂; Palmar, Rio Casenare, Boyacá, Colombia. April, 1917. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 899.]

In addition to the characters given in the generic diagnosis, the following are considered of specific value. Size medium small, form medium, for the Melanopli. General appearance strongly suggesting a short-winged species of the genus *Melanoplus*. Head with interocular space slightly wider than first antennal joint, lateral carinae of vertex weak but distinct, running across fastigium and continued as the weak lateral carinae of the frontal costa to clypeus, interval between these on vertex and fastigium weakly concave. Fastigium weakly produced, decidedly broader than long (when including the lateral ocelli). Frontal costa with surface feebly concave, in lateral aspect straight, dorsad curving weakly to the fastigium and there forming a very blunt fastigio-facial angle. Supplementary facial carinae slightly stronger. Eye very slightly longer than broad; broad but decided infra-ocular sulcus three-fifths as long as eye. Antennae filiform, about one and three-quarters times as long as the pronotum. Pronotum with disk very feebly convex, rounding rather suddenly into the lateral lobes, medio-longitudinal carina weak but distinct only in metazonal portion, transverse sulci weak, disk scarcely widening caudad, its caudal margin very feebly convex with a trace of

angulation. Tegmina roughly broad oval, specialized as characteristic of the genus. Prosternal spine slenderly conical with apex well rounded. Interval between mesosternal lobes subquadrate. Abdomen moderately clavate distad. Furcula represented by minute and nearly attingent rounded projections. Supra-anal plate triangular with lateral margins showing very faint convexity and apex rounded, as long as wide, mediolongitudinally sulcate proximad, and proximad at the lateral angles with a very short, delicate carina directed toward the apex. Cerci moderately broad, narrowing in proximal two-thirds, then suddenly narrower, this forming a rounded node on the ventro-external margin, the remaining distal third[159] bent strongly inward and directed slightly dorso-cephalad, narrowing to its sharply rounded apex. Subgenital plate small and very roundly conical, its apex very broadly but evenly rounded. Caudal tibiae with eight to nine (in series) dorso-external and nine to ten (in series) dorso-internal, bicolored spines.

Allotype.—♀; same data as type. [Hebard Collection.]

Differs from male as follows. Size larger, form decidedly more robust. Interocular space nearly one and one-half times as wide as proximal antennal point. Eye slightly longer than wide. Pronotum with disk feebly expanding caudad, its caudal margin even more broadly convex, without trace of angulation. Tegmina proportionately larger. Interval between mesosternal lobes strongly transverse. Ovipositor valves normal, not strongly curved distad.

Coloration. Male. Vertex, occiput, dorsal surface of pronotum, discoidal field of tegmina, dorsal surface of abdomen and of caudal femora warm sepia, the dorsal genitalia often cameo brown. The pronotum and occiput are darkest, the abdomen and caudal femora having darker flecks. Eyes and a hair line bordering occiput sayal brown (paler), with a broad postocular bar of blackish brown, continued to include dorsal portion of lateral lobes, pleura and sides of abdomen proximad. The pleura with an oblique linear streak and dot of buffy, the marginal field (lateral portion) of the tegmina darkened but not in sharp contrast. Face and genae dorsad brownish buff irregularly suffused with olivaceous, genae ventrad and more than ventral half of lateral lobes brownish buff, the latter with sulci suffused, the dorsal margin of this pale area convex dorsad. Cephalic and median limbs oil green, the femora suffused with brown dorso-cephalad throughout. Caudal femora with internal and external faces oil green, externally deepening to cerro green distad,

[159] Several paratypes show some variation in having this portion of the cerci longer, equalling two-fifths of the cercal length. This is more as in *varicolor*, but, unlike that species, the distal portion tapers to the apex, as is typical for *casenare*.

ventral surfaces of these limbs and body mustard yellow, genicular areas cameo brown. Caudal tibiae cameo-brown proximad brightening to jasper red distad, spines and spurs buffy with a pink tinge, black tipped.

Female. Differs as follows from male. Limbs brown except caudal tibiae which are pompeian red throughout, caudal femora sometimes marked externally with buffy ventrad and more briefly dorsad. Tegmina with marginal (lateral) field often darker and in sharper contrast with discoidal (dorsal) field.

Slight maculation in the brown areas is weakly indicated in both sexes.

The measurements of the type and allotype are given first. Length of body,[160] ♂, 13.8, 13.2 to 14.9; ♀, 19.4, 17.3 to 19.2: length of pronotum, ♂, 4, 3.7 to 4; ♀, 4.3, 4.1 to 4.7: caudal width of pronotal disk, ♂, 2.9, 2.7 to 2.9; ♀, 3.8, 3.7 to 4: exposed length of tegmen, ♂, 3.4, 3.6 to 3.2; ♀, 4.8, 4.8 to 4.8: greatest tegminal width, ♂, 2.2, 2.3 to 2.2; ♀, 3.2, 3.1 to 3.3: length of caudal femur, ♂, 9, 8.7 to 8.8; ♀, 10.3, 10.3 to 10.9 mm.

In addition to the type and allotype, a series of four male and five female paratypes, bearing the same data, has been studied. The locality Palmar is on the edge of the great Llanos de Casenare.

Chibchacris digitifera new species (Plate XVI, figures 5, 6 and 7.)

This insect agrees with *C. furcata*, here described, in the absence of male furcula and the truncate, bifid subgenital plate. The flattening and expansion of the pronotal disk caudad is a conspicuous feature in the female sex, though not as pronounced as in that sex of *furcata*.

Though showing a generally deep green coloration, males of this species have the genae and frequently portions of the lateral lobes of the pronotum ventrad paler, in this respect showing a somewhat intermediate type between that developed in the same sex of *C. casenare*, here described, and *furcata*.

Type.—♂; La Pica, Santander, Colombia. Elevation, 9000 feet. February 10 to 15, 1917. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 900.]

Agrees in all characters not given below with the generic diagnosis and the description of the male of *casenare*. Size

[160] The males of this species all have the abdomen strongly curved upward distad. A greater body length would be shown if these were straight.

larger. Eye distinctly longer than broad, infra-ocular sulcus two-fifths as long as eye. Abdomen rather strongly clavate distad. Furcula absent. Supra-anal plate proportionately very slightly shorter than in *casenare*, with two faint parallel ridges in distal portion. Cerci moderately broad in proximal two-fifths, then suddenly much narrower, this forming a very sharply rounded rectangulation in ventro-distal portion, the dorsal portion thence produced in an elongate, slender and very weakly curved finger, bent moderately inward and directed dorso-caudad, which tapers very gradually to its strongly rounded apex. Subgenital plate large, truncate conical, with a short median impression at apex, so that this portion appears bluntly bifid. Caudal tibiae with (eight to nine) dorso-external and (nine to ten) dorso-internal bicolored spines.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Differs from male as follows. Size decidedly larger, form much more robust, decidedly more so than in females of *casenare*. Interocular space nearly one and one-half times as wide as proximal antennal joint. Pronotum with disk expanding considerably caudad, its caudal margin very broadly convex but showing a trace of angulation. Tegmina proportionately similar (in the series varying in both sexes). Interval between mesosternal lobes strongly transverse. Ovipositor valves as in *casenare*, normal, not strongly curved distad.

Coloration. Male. Vertex, occiput, dorsal portion of genae, all of pronotum, abdominal tergites to distal portion and dorsal surface of caudal femora brownish olive, the green shade stronger laterad, the lateral lobes often paler in ventral portion. Face and ventral portions of genae ecru-olive. Tegmina verona brown or slightly darker. Dorsal genitalia and genicular areas of caudal femora roods brown. Ventral surface primuline yellow, tinged with olive laterad on abdomen. Cephalic and median femora olive yellow, becoming dark greenish olive dorsad. Caudal femora with external surface jade green, paling to primuline yellow ventrad. Caudal tibiae purplish brown proximad, becoming carnelian red distad, the spines and spurs pinkish, black tipped.

Female. Differs from male as follows. Face, genae and ventral portion of pronotal lateral lobes often clear buffy brown. Sometimes this pale area is thickly mottled with flecks of dark brown and in such specimens the dorsal surface of the head, pronotum and caudal femora is similar, paler with dark mottling. Limbs brown except caudal tibiae, which are pompeian red, often brightening to dragons-blood red distad. Tegmina with marginal field rarely darker than discoidal field.

The measurements of the type and allotype are given first. Length of body, ♂, 15.7, 13.8 to 16; ♀, 16.4 (abdomen shrivelled)

17 to 21: length of pronotum, ♂, 4.2, 3.9 to 4.2; ♀, 5.4, 4.2 to 5.7: caudal width of pronotal disk, ♂, 3.1, 2.8 to 3.1; ♀, 4.8, 3.8 to 4.8: exposed length of tegmen, ♂, 3.9, 3.2 to 4.2; ♀, 4.2, 3.4 to 5.8: width of tegmen, ♂, 2.7, 2.3 to 2.8; ♀, 3.6, 3.2 to 4: length of caudal femur, ♂, 9.3, 8.5 to 9.8; ♀, 11.4, 10 to 11.8 mm.

In addition to the type and allotype, a series of seventeen male and twenty-three female paratypes are before us. This material was all secured in a grassy marsh.

Chibchacris furcata new species (Plate XVI, figures 8, 9 and 10.)

This is the largest, most robust and brilliantly colored of the known species of the genus. It shows a general progressive development of the specialization found in *C. digitifera* here described, the male being further separable by the distinctive, furcate cerci.

Type.—♂; La Pica, Santander, Colombia. Elevation, 9000 feet. February 10 to 15, 1917. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 901.]

Agrees in all characters not given below, with the generic diagnosis and the male of *C. casenare* here described. Interocular space distinctly longer than broad, infra-ocular sulcus three-fifths as long as eye. Abdomen rather strongly clavate distad. Furcula absent. Supra-anal plate much as in *casenare*, but showing the faint parallel ridges distad as in *digitifera*. Cerci moderately broad in proximal three-fifths, then suddenly much narrower, with a very small conical projection disto-ventrad, forming a U with the slenderly produced disto-dorsal portion, the latter slightly thickened and then continued as a straight, slender finger, scarcely tapering beyond its base and nearly straight to its strongly rounded apex, this finger directed very slightly more inward than the proximal portion of the shaft and pointing dorso-caudad. Subgenital plate large, broadly truncate conical with a short median impression at apex, so that this portion appears bluntly bifid, much as in *digitifera* but even broader and blunter. Caudal tibiae with (eight to ten in series) dorso-external and nine to eleven (rarely more than ten) dorso-internal bicolored spines.

Allotype.—♀; same data as type. [Hebard Collection.]

Differs from male as follows. Size decidedly larger, form very much more robust. Interocular space slightly over twice width of proximal antennal joint. Pronotum with disk expanding strongly caudad, its caudal margin very broadly convex. Teg-

mina proportionately slightly more ample (in the series variable in both sexes). Interval between mesosternal lobes strongly transverse, nearly twice as broad as deep. Ovipositor valves normal, not strongly curved distad.

Large immature males show a broad truncation and median impression distad of the subgenital plate, but no specialization of the still simple cerci.

Coloration. Male. Dorsal surface of head, dorsal portions of genae and caudal femora and all of pronotum olivaceous black, lateral portions shining. Remaining portions of face and genae yellowish buff washed with olivaceous, the mouthparts yellowish buff flecked with dark brown. Eyes and antennae proximad bay, antennae distad and tegmina carob brown, the latter often somewhat paler. Pleura olivaceous with an oblique yellowish line. Dorsal surface of abdomen dull russet, darker laterad, the dorsal genitalia clear russet. Ventral surface clear primuline yellow. Cephalic and median limbs deep spinach green externally, greenish yellow internally. Caudal femora with all but dorsal surface deep spinach green (individually varying to as pale as javel green), genicular areas carob brown. Caudal tibiae pompeian red proximad, paling to jasper red distad, the spines jasper red, black tipped.

Female. Differs from male as follows. General coloration carob brown, often fading to yellowish on head and pronotum, sometimes with a much darker post-ocular bar crossing lateral lobes of pronotum. Face, genae and ventral portions of lateral lobes mustard yellow, the dorsal margin of this pale area convex dorsad and sharply defined on the pronotum. Ventral surface yellowish buff often tinged with orange, sides of abdomen and internal surface of caudal femora, particularly proximad, washed with scarlet. Cephalic and median limbs yellowish brown. Caudal femora externally dull dark claret brown or blackish brown, the dorsal surface usually buffy, genicular areas claret brown. Caudal tibiae maroon, brightening to claret red distad.

The measurements of the type and allotype are given first. Length of body, ♂, 17.8, 15.2 to 19; ♀ (abdomen shrivelled in all), 16 to 19: length of pronotum, ♂, 5, 4.7 to 5.3; ♀, 6.7, 5 to 6.3: caudal width of pronotal disk, ♂, 3.8, 3.7 to 3.9; ♀, 6, 5 to 5.8: exposed length of tegmen, ♂, 4.9, 4.8 to 6.2; ♀, 6.7, 5.1 to 6.1: width of tegmen, ♂, 3, 2. 9 to 3.9; ♀, 4.8, 3.8 to 4.6: length of caudal femur, ♂, 10.7, 10 to 11.7; ♀, 12.9, 10.5 to 12.3 mm.

In addition to the type and allotype a series of nineteen individuals, bearing the same data, have been studied by us.

Aidemona azteca (Saussure)

1861. *Platyphyma azteca* Saussure, Rev. et Mag. de Zool., (2), XIII, p. 161. [♂, Temperate Mexico.]

Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, VII, 10, 1913, (M. A. Carriker, Jr.), 1 ♀.

Hacienda Vista Nieve, Sierra San Lorenzo, Magdalena, X and XI, 1917, (M. A. Carriker, Jr.), 3 ♂, 3 ♀.

Cali, El Valle, V, 27, 1914, (H. S. Parish), 1♂, [A. N. S. P.].

Though not previously known from South America, we have reason to believe that this species has a continuous distribution from as far north as Mazatlan, Mexico, to the localities here given. The insect is one of the most abundant species found in central and southern Mexico.

Group *Agesandri*

Agesander ruficornis Stål (Plate XVI, figures 11 and 12.)

1878. *A[gesander] ruficornis* Stål, Bihang till K. Svenska Vet. Akad. Handl., v, no. 4, p. 81. [♂, ♀; Colombia.]

Bogotá, Cundinamarca, II, VII, 24, VIII, IX, 16 and XI, 23, 1916 and 1917, (from A. Maria), 11 ♂, 7 ♀.

This handsome and very distinctive insect has a general facies suggesting some of the more fusiform brachypterous genera of the Melanopli. The cleft apex of the frontal costa might lead one to seek Pyrgomorphine affinity, but in all other respects, even of the fastigial contour, the true Crytacanthacrine affinity is shown. This sulcation of the vertex and frontal costa is usually, but not always, continuous.

In locating this genus Giglio-Tos' key must be used with care, the fastigio-facial angle being as in the Group Coscineutae, which it consequently follows and does not run to a position before the Group Rhytidochrotae. This error, discovered too late for correction in this paper, first occurs in Brunner's key, the genus *Agesander* being there placed incorrectly before *Rhytidochrota*.

The most striking characters of the present species are as follows. Pronotum without longitudinal carinae but with deep transverse sulci. Tegmina very small, very slenderly but bluntly lanceolate, with a single conspicuous medio-longitudinal vein. Ventral margin of caudal femora with a sudden distal concavity. Male cerci very distinctive.

Stål may have confused the sexes in his color description. The males before us are yellowish oil green, more yellowish on the facial carinae, sides of occiput, genae and prozona. Antennae and tegmina pompeian red, the clypeus and labrum washed with a brighter shade. Abdomen with a broad lateral band of scarlet red to apex of subgenital plate and a suffusion of the same mesad on the penultimate sternite. Caudal femora immaculate with genicular areas darker but tipped with yellow dorsad and with the genicular lunules blackish. Caudal tibiae jade green with black bases and a sub-basal fleck of yellow dorsad, the spines and spurs buffy, black tipped.

The females are usually reddish brown, the head and pronotum sometimes suffused with olivaceous. The antennae, sides of the abdomen and sometimes the cephalic femora are a duller red, the caudal femora with carinae and external pagina buffy, the latter often with a marginal suffusion of reddish. The caudal tibiae are as in the male.

The extremity of the male abdomen is curved dorsad and moderately clavate. Length of body, ♂, 15.8 to 17.8; ♀, 24 to 26: length of pronotum, ♂, 3.8 to 4; ♀, 4.3 to 4.4: exposed length of tegmen, ♂, 3.1 to 3.4; ♀, 4 to 4.2: greatest width of tegmen, ♂, .8 to .9; ♀, 1.1 to 1.2: length of caudal femur, ♂, 10 to 10.9; ♀, 12.9 to 13: greatest width of caudal femur, ♂, 2.6 to 2.8; ♀, 2.9 to 3.1 mm.

Group *Rhytidochrotae*

The genera included in the following key represent a progression from the simplest type (*Rhytidochrota*) to the most specialized (*Piezops*) along the same lines, except in the case of *Muyscacris*, which shows specialization differing from that of any of the other genera.

Bruner has described two species, *Rhytidochrota peruviana*[161] and *Rhytidochrota boliviana*,[162] both of which are members of the Ommatolampid genus *Psiloscirtus* Bruner.[163]

[161] Horae Soc. Ent. Rossicae, XXXIX, p. 24, (1910).

[162] Ann. Carnegie Mus., XIII, p. 90, (1919).

[163] Material representing both of these species is in the author's collection, including a large topotypic series of the latter.

Key to the Genera of the Group Rhytidochrotae

A. Vertex weakly declivent.

B. Antennae filiform. Caudal femora with dorsal carinae alone feebly serrulate or subserrulate, the medio-dorsal carina feebly or not at all produced at apex. Frontal costa suddenly but not strongly produced between antennae. (Longest spine of caudal tibiae distinctly less than twice width of tibia at its base.)

C. Pronotum with narrow cephalic portion not or but weakly ascendant,[164] the occiput less convex and not or feebly raised. Face not showing concavity. (Size medium small to small. Tumid prosternum with a small median tubercle.)

D. Interocular space slightly wider than or subequal to width of frontal costa. Pronotum lacking lateral projections. Frontal costa with surface deplanate or with lateral margins very faintly and coarsely carinate.

E. Large tympanum present. Antennae coarsely filiform, in male shorter than caudal femur. Surface of produced portion of frontal costa impresso-punctulate, sometimes with feeble lateral carinae. Face, genae and lateral lobes of pronotum rugulose. Pronotum with cephalic portion not raised.

Rhytidochrota Stål

Genotype.—*R. turgida* Stål (Colombia)

EE. Tympanum absent. Antennae slenderly filiform, in male longer than caudal femur. Surface of produced portion of frontal costa usually smooth, lateral carinae absent. Face, genae and lateral lobes of pronotum with a horizontal pale band, the surface in this portion smooth. Pronotum with cephalic portion weakly or distinctly raised.

Paropaon new genus

Genotype.—*P. laevifrons* (Stål) (Amazon)[165]

DD. Interocular space very wide, much (in female three times) wider than width of frontal costa. Pronotum with conspicuous, though small, lateral projections. Frontal costa with lateral margins rather strongly carinate. (Tympanum absent. Pronotum with cephalic portion not raised.) . . . . . *Muyscacris* new genus

Genotype.—*M. panchlora* new species (Colombia)

[164] Exception. In one species of *Paropaon* this feature is as in CC.

[165] Material of this species from Teffe, Amazonas, Brazil and Iquitos, Loreto, Peru, is in the author's collection, as well as a Bolivian series of an undescribed species of the same genus.

CC. Pronotum with cephalic portion narrowly ascendant, embracing the convex and raised occiput. Face showing distinct concavity. (Pronotum lacking lateral projections. Frontal costa lacking lateral carinae. Large tympanum present.)

D. Size smaller. Surface of frontal costa, head and pronotum almost smooth. Mesonotum and metanotum unspecialized. Median segment tumid. Tumid prosternum with a minute tubercle mesad.

Opaonella new genus

Genotype.—*O. tenuis* new species (Colombia)

DD. Size larger. Surface of frontal costa and occiput impresso-punctate, the other portions of head and pronotum rugulose. Mesonotum and metanotum specialized. Prosternal spine moderately stout.....*Opaon* Kirby

Genotype.—*O. granulosus* Kirby (Ecuador)

BB. Antennae slenderly ensiform. Caudal femora, frontal costa, pronotum, mesonotum, metanotum and prosternal spine as given for section AA. (Longest spine of caudal tibiae nearly twice width of tibia at its base. Size large. Large tympanum present.).....*Parapiezops* new genus

Genotype.—*P. homalonotus* new species (Colombia)

AA. Vertex horizontal. (Antennae heavily ensiform. Caudal femora with dorsal and ventral carinae denticulate, the dorsal carina produced in a minute, sharp spine at apex. Frontal costa suddenly and strongly produced between antennae, its lateral margins very strongly carinate (in fact sublamellate). Pronotum with cephalic portion narrowly ascendant, embracing the convex and raised occiput. (Longest spine of caudal tibiae nearly three times width of tibia at its base. Prosternal spine slender, moderately large. Face showing decided concavity. Pronotum, mesonotum and metanotum specialized. Size large. Large tympanum present.).....*Piezops* new genus

Genotype.—*P. ensicornis* (Stål) (Panama[166])

RHYTIDOCHROTA Stål

This genus is here restricted to include only those species which Stål described and assigned, in 1878, to the last division of his *Rhytidochrota, turgida*[167] and *brunneri*, as well as *R. polia* here described; of these *turgida* has been selected as genotype by Kirby. All of these species are peculiar to the Colombian highlands.

[166] Panamanian material of this striking and distinctive insect is before us and will be more fully discussed in a study of the Acrididae of that country.

[167] It is very probable that his *antennata* represents a male of *turgida*, described from a female and both from the Department of Antioquia, Colombia.

The genus, as restricted, may be recognized by the following characters. Size medium small. Caudal tibiae armed with (seven or eight) dorso-external spines, this margin lacking an apical spine; none of the spines of these tibiae much longer than the tibial width at their base. Fastigium small, strongly declivent, slightly wider than long, triangular with obtuse apex. Frontal costa suddenly, but not strongly, produced between antennae; its surface impresso-punctulate, deplanate or showing feeble lateral carinae. Caudal tarsus with second joint short, third as long as combined length of first and second. Caudal femora moderately elongate, dorsal carinae with subobsolete serrulations. Frontal costa in lateral aspect showing broad but weak concavity below produced portion. Organs of flight absent. Large tympanum present. Pronotum cylindrical dorsad with heavy transverse sulci, the intervals between these roundly elevated in the male sex, the dorsum scarcely ascendant toward the cephalic margin. Mesonotum, metanotum and median segment unspecialized. Antennae coarsely filiform, not as long as caudal femora, longer in male than in female. Head normal. General appearance of male that of an apterous member of the Melanopli; female robustly subfusiform.

Rhytidochrota brunneri Stål

1878. *R[hytidochrota] brunneri* Stål, Bihang till K. Svenska Vet. Akad. Handl., v, no. 4, p. 78. [♂, Colombia.]

La Cumbre, Cordillera Occidental, El Valle, V, 16, 1914, (H. S. Parish), 2 ♀, [A. N. S. P.].

"Colombia," 1 ♂, [Museum of Comparative Zoology].

The above females can not be associated with certainty, that sex of *brunneri* not having been described. From the sex contrast shown by the series of *R. polia* here described, however, the present association appears to be very probably correct.

These females are much larger than the male, subfusiform, dull brown with caudal tibiae paler and antennae alone pompeian red, becoming dark distad.

Rhytidochrota polia new species (Plate XVII, figures 1 and 2.)

The male of this species is very distinctive in its black color, with pale palpi, red apices of the caudal femora and white hairy covering of pronotum, mesonotum, metanotum and

median segment. In proportions it shows close agreement with the male described by Stål as *antennata*, from Remedios, Antioquia, which name we believe to be a synonym of *R. turgida* Stål.

The much larger subfusiform female sex shows much less distinctive coloration, but greater diversity from the male than is true for the females we have here referred to *R. brunneri* Stål. It agrees closely with the quite inadequate description of *turgida*, based on a female from Antioquia. The measurements and coloration of that insect, when given, we believe will show decided differences.

Type.—♂; La Palmeta, Santander, Colombia. Elevation, 7500 feet. July 15 to 20, 1916. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 903.]

In addition to the characters given in the generic discussion, the following are considered to be of specific value. Size medium small, larger than *brunneri;* form medium. Head with interocular space very slightly narrower than first antennal joint, very slightly wider than frontal costa between antennae. Fastigium broadly but appreciably sulcate. Frontal costa deplanate and shallowly impresso-punctate dorsad, then with coarse lateral carinae distinctly raised but irregular from below median ocellus to clypeus; lateral carinae of face equally prominent. Face smooth mesad on occiput and narrowly ventrad and caudad of eyes, elsewhere irregularly rugose with shallowly impressed punctae. Infra-ocular sulcus two-fifths as long as the prominent eyes. Antennae relatively heavy and elongate. Pronotum, mesonotum, metanotum and median segment heavily clothed with relatively coarse, elongate, silvery gray hairs. The eight smooth areas[168] described by Stål for *antennata*, appear to be duplicated in this insect by small spots where this hair does not occur. Pronotum with cephalic margin of disk weakly produced mesad, there rounded on each side to form a small median angulate-emargination, caudal margin transverse with a very minute median emargination. Prosternum decidedly convex, surmounted by a minute, sharp, median tubercle. A weak medio-longitudinal carina extends from mesonotum to distal portion of abdomen, the latter gradually tapering to its rounded apex. Furcula represented by comparatively large triangular projections, separated by a triangular emargination of equal size. Supra-anal plate very simple, shield-shaped, weakly sulcate meso-proximad. Cerci short, simple, conical, shorter than supra-anal plate. Subgenital plate small, rounded,

[168] We are convinced that Stål gave this feature undue emphasis in his key.

dome-shaped. Limbs comparatively elongate, the cephalic and median femora slender and straight. Caudal femora with dorsal carinae showing a few subobsolete serrulations, best considered smooth, medio-longitudinal carina terminating distad in a broad and very feeble, bluntly triangular projection. Caudal tibiae with eight (occasionally seven) dorso-external spines which are proportionately somewhat longer than in *brunneri*. Coloration very distinct.

Allotype.—♀; same data as type. [Hebard Collection.]

Differs from male as follows. Size decidedly larger; form more robust, subfusiform. Head with interocular space slightly wider than proximal antennal joint, the latter subequal in width to frontal costa between antennae. Fastigium with large, shallowly impressed punctae, sulcation weaker. Frontal costa more strongly impresso-punctate, lateral carinae strong only for a very short distance below median ocellus,[169] then obsolete. Infra-ocular sulcus nearly three-fifths as long as the less prominent eye. Antennae slightly less heavy and proportionately decidedly shorter. Pronotum, mesonotum, metanotum and median segment with hairs inconspicuous, surface heavily and finely rugose and impresso-punctate; eight smooth areas inconspicuous. Pronotum broadening evenly and quite considerably caudad, with intervals between the sulci flattened. Medio-longitudinal carina indicated only on abdomen. Ovipositor valves stout, roughly toothed; dorsal valves with apices moderately curved, ventral valves with ventral margin almost straight to apex. Subgenital plate produced in a large triangle, fitting tightly between the bases of the ovipositor valves.

Coloration. Male. Shining black, showing a faint greenish tinge, with pronotum, mesonotum, metanotum and median segment very heavily clothed with silvery gray hair. Eyes blackish brown. Palpi clear mustard yellow. Entire genicular areas of caudal femora and brief proximal portion of caudal tibiae nopal red, (much brighter and deeper than in *brunneri*, in which species the antennae and palpi are of the same red color). Spines and spurs of caudal tibiae greenish black.

Female. Cinnamon brown with transverse sulci and intersections of all dorsal segments darker. Mesonotum, metanotum, meso-episternum and meso-epimerum darker than elsewhere. Limbs cinnamon brown with dorsal surfaces of femora varyingly paler, often suffused antimony yellow. Caudal femora with genicular areas nopal red, with dorsal surface clear antimony yellow. Caudal tibiae and metatarsi nopal red, the other tarsal joints buffy tinged with red; internal spines black, external

[169] Individually variable, the lateral carinae sometimes subobsolete.

spines black to their nopal red bases. Entire ventral surface blackish,

These sexual color differences are fully developed in half-grown immature individuals.

Measurements (in millimeters)

♂	Length of body	Greatest body width	Length of antenna	Length of pronotum	Length of caudal femur	Greatest width of caudal femur
La Palmeta, *type*.....	16.8	4.7	10.8	4	12.8	2.8
La Palmeta, *paratype*..	14.6	4.4	10.6	3.2	11.6	2.6
La Palmeta, *paratype*..	16.5	4.6	11.2	3.8	12.8	2.9
Pueblo Nuevo de Ocaña.	17	—	11.2	3.5	11.8	2.8
♀						
La Palmeta, *allotype*...	22	6.9	10.7	3.9	14	3.2
La Palmeta, *paratype*..	18.4	5.3	10	3.8	12.8	2.9
La Palmeta, *paratype*..	23	6.8	10.5	4.1	14.9	3.3

Specimens Examined: 28; 9 males, 10 females and 9 immature individuals.

La Palmeta, Santander, VII, 15 to 20, 1916, (M. A. Carriker, Jr.), 8 ♂, 10 ♀, *type, allotype, paratypes,* 4 juv. ♂, 3 juv. ♀.

Pueblo Nuevo de Ocaña, Santander, IX, 3, 1916, (M. A. Carriker, Jr.), 1 ♂, 2 juv. ♀.

MUYSCACRIS new genus

Erected to include the single species, *M. panchlora* here described, this genus is in some respects annectant between *Rhytidochrota* Stål (sensu strictiore) and *Parapiezops* here described; differing from both in the considerably greater interocular width, which in the female is three times that of the frontal costa, and in other important features showing a line of different specialization from any of the other genera of the Group.

It agrees with both the above genera in the number of caudal tibial spines and absence of organs of flight; with *Rhytidochrota* in the general form and degree of production of the frontal costa, unspecialized mesonotum and metanotum and normal head; with *Parapiezops* in the longer caudal tibial spines, which

are distinctly longer than the tibial width at their bases and apparently cleft apex of the vertex, due to the slender but prominently projecting lateral carinae of the narrow frontal costa, (this being cleft, rather than concave mesad as in *Piezops*).

The following additional characters we consider of value in locating the genus. Size relatively large. Caudal tibiae armed with seven dorso-external spines, this margin lacking an apical spine. Fastigium moderately large, flattened, moderately declivent, slightly wider than long. Caudal tarsi with second joint short, third as long as combined length of first and second joints. Caudal femora with dorsal carina closely but minutely serrulate in proximal portion, terminating in a very minute, acute projection. Tympanum absent. Pronotum cylindrical dorsad with decided transverse sulci, but with intervals between these not strikingly elevated,[122] not ascendant toward cephalic margin, specialized latero-mesad. Eye shorter than infra-ocular sulcus. Antennae filiform (broken so their length can not be determined). General appearance distinctive, smooth, robustly subfusiform.

Affinity to this genus is apparently shown by Stål's *Rhytidochrota pilosa* from Peru. The narrow interocular space we believe will prove one of a number of features necessitating the assignment of that insect to a distinct genus.

Muyscacris panchlora new species (Plate XVII, figures 3 and 4.)

The present insect is readily recognizable in the female sex by the broad interocular space, uniform green general coloration and robustly subfusiform contour, which shows specialization only on the pronotum laterad between the second and principal sulci, where dorsad on each side a small horizontal, trapezoidal projection occurs.

Type.— ♀ ; Cali, El Valle, Colombia. Elèvation, 3500 feet, February, 1912. (Miller and Allen.) [Hebard Collection, Type no. 904.]

In addition to the characters noted in the generic diagnosis, the following are considered aids in locating this species. Frontal costa very weakly indicated below its produced portion. Body very sparingly pilose, face and limbs more strongly so. Surface of head smooth, lateral carinae of face subobsolete. Eye moderately prominent, scarcely longer than broad, its length less than that of the almost obsolete infra-ocular sulcus.

[170] In female sex, which alone is known.

Pronotum almost smooth, showing mere traces of rugae, dorsal portion of lateral lobes in small area between first and second sulci showing weak thickening, area between second and principal sulci at lateral extremity of disk, horizontally produced on each side in a small, bluntly trapezoidal projection. Surface of other dorsal segments as smooth as pronotum, unspecialized, becoming shining on abdomen where a trace of medio-longitudinal carination is found. Prosternum thickened and produced mesad in a stout, blunt-conical spine. Mesosternum and metasternum faintly impresso-punctulate, the mesosternal interspace very broad. Ovipositor valves heavy, the dorsal with externo-dorsal margin coarsely and bluntly dentate, weakly curved only at the very short apices. Caudal femora moderately stout throughout.

General coloration dark greenish olive, paling to light yellowish olive on ventral surfaces of limbs. Eyes rich russet. Genicular areas of caudal femora and bases of caudal tibiae olive ocher, genicular crescents brownish olive. Caudal tibiae light yellowish olive, becoming brownish olive distad, spines and spurs black tipped, all tarsi suffused with pinkish brown. Ventral surface dull primuline yellow. Hairs silvery white.

Length of body, 28.3; greatest body width, 8; length of pronotum, 4.7; length of caudal femur, 17; greatest width of caudal femur, 3.5; length of longest caudal tibial spine, 1.1 mm.

The type of this unusual insect is unique.

OPAONELLA new genus

This genus is erected to include the single new species, *O. tenuis*. It is nearest *Opaon* Kirby, of which genus a single undescribed Ecuadorean species is before us, while to that entity also very possibly belongs Stål's Colombian *Rhytidochrota sellata*.

Agreement with *Opaon* is shown by the following features. Form comparatively slender. Interocular space narrow and feebly sulcate in males.[171] Fastigium declivent and with truncate apex entire, due to the absence of lateral carinae on the frontal costa. Eyes bulbous, decidedly longer than infraocular sulcus. Frontal costa suddenly produced between antennae, with surface deplanate, in lateral aspect showing marked concavity ventrad. Antennae elongate, filiform. Pronotum with deep transverse sulci; sellate, due to the narrow cephalic portion ascending to embrace the moderately ascendant, convex occiput. Interval between mesosternal lobes feebly

[171] Similar in females of *Opaonella*, but broader and not sulcate in females of *Opaon*.

transverse in male, distinctly so in female. Apterous. Large tympanum present. Caudal tibiae with seven (rarely six)[172] dorso-external spines, lacking a distal spine on this margin, the longest of these decidedly longer than the tibial width at its base.

The present genus differs from *Opaon* as follows. Size smaller. Surface of frontal costa, head and pronotum almost smooth, (the frontal costa and occiput impresso-punctate, the other portions of head and pronotum rugulose in *Opaon*). Mesonotum and metanotum unspecialized, median segment tumid mesad (with surface of body consequently lower cephalad and caudad). Tumid prosternum with a very minute tubercle.

The general appearance of this insect suggests a very slender type of *Rhytidochrota* (sensu strictiore), with very elongate antennae and limbs, inflated occiput and somewhat more prominent eyes and projection of frontal costa.

The peculiar concavity of the face, so decided in *Piezops*, nearly as striking in *Parapiezops* and weaker in *Opaon*, is linearly first suggested in this genus of the Group Rhytidochrotae.

Opaonella tenuis new species (Plate XVII, figures 5 and 6.)

The striking orange-chrome coloration of the first four abdominal tergites[173] in the male and portions of the first three abdominal tergites[173] in the female is a distinctive feature.

The species is subject to decided size variation, the general coloration also varying from black to blackish brown and different shades of russet.

Type.—♂; Muzo, Boyacá, Colombia. Elevation, 2700 feet. September, 1919. (From A. Maria.) [Hebard Collection, Type no. 905.]

The following characters are of specific value, and are added to those given in the generic diagnosis. Size medium small, form slender. General appearance of surface smooth and shining; body very inconspicuously pilose, limbs slightly more pilose. Occiput smooth, with a very faint medio-longitudinal carina briefly indicated in area between caudal portions of eyes. Frontal costa obsolete below produced portion, the face with a transverse sulcus at that point; lateral carinae of face subobsolete. Eye prominent, distinctly longer than broad, slightly more than twice as long as the subobsolete infra-ocular

[172] On one tibia in one of the series of specimens before us.

[173] Not including the median segment.

sulcus. Interocular width slightly less than that of frontal costa. Pronotum with intervals between the transverse sulci moderately roundly elevated and in this feature alone more similar to *Rhytidochrota;* the dorsal surface, however, showing some slight flattening. Mesosternum and metasternum almost smooth, subtuberculate about their periphery. Mesosternal interspace feebly transverse. Abdomen gradually narrowing to the rounded apex, with a weak medio-longitudinal carina. Furcula represented by rounded triangular projections, largely (sometimes wholly) fusing with the supra-anal plate, the latter very simple, triangular with apex rounded and lateral margins feebly convex, its surface unspecialized. Cerci simple, short, conical. Subgenital plate very small, simple, rounded subconical. Caudal femora proportionately slightly less enlarged proximad than in *Opaon,* subserrulate dorsad in that portion, medio-dorsal carina with apical production subobsolete.

Allotype.— ♀ ; same data as type. [Hebard Collection.]

Differs from the male as follows. Size larger, form somewhat less slender. Genae decidedly longer, infra-ocular sulcus two-thirds as long as eye. Intervals between pronotal sulci broader and more flattened. Mesonotum, metanotum and median segment rugulose, the latter not only tumid but medio-longitudinally carinate. Mesosternal interspace more distinctly transverse. Ovipositor comparatively small, dorsal valves briefly curved at apex, ventral valves with ventral margin straight to apex.

Coloration. Male. Head, pronotum, mesonotum, metanotum, pleura and median segment black, individually varying to olivaceous black, in some with ventral portions of pronotal lateral lobes and pleura testaceous. Eyes tawny olive. Antennae usually dragon-blood red, individually decidedly variable, as they are black in the darkest pair of the series. Four dorsal tergites succeeding the median segment uniform orange chrome, the first of these black meso-proximad in two individuals; remainder of dorsal portion of abdomen dull ferruginous, or brownish olive in the dark specimens. Limbs dull ferruginous, caudal femora sometimes vinaceous-rufous or of this color in genicular area only; limbs black in dark specimens, caudal tibiae paler, olivaceous, with spines and spurs black tipped. Ventral surface vinaceous-rufous, dull except on abdomen; black in dark individuals with prosternal spine, mesosternum and metasternum conspicuously washed with lemon chrome, the latter condition shown in two of the paler females also.

Female similarly colored in every way except that the three tergites succeeding the median segment alone are marked with orange chrome and this largely confined to the lateral portions, leaving a narrow or broad medio-dorsal portion of the dark

general coloration, while the lateral lobes of the pronotum have a horizontal buffy streak meso-ventrad, running from the cephalic margin to the principal sulcus.

It is evident that the species is subject to unusual color variation.

Measurements (in millimeters)

♂	Length of body	Greatest width of body	Length of pronotum	Length of caudal femur	Greatest width of caudal femur	Length of longest caudal tibial spine
Muzo, *type*.....	16	3.4	2.9	12	2	.8
Muzo, *paratype*..	17.7	4.2	3.1	13	2.3	.8
Pacho, *paratype*.	15.9	3	2.7	10	2	.7
♀						
Muzo, *allotype*. .	22.8	5	3.8	14.1	2.9	.9
Pacho, *paratype*.	18.5	4.8	3.2	12.7	2.4	.8
Pacho, *paratype*.	21	4.9	3.2	13.7	2.7	.9

Specimens Examined: 30; 12 males and 18 females.

Muzo, Boyacá, 2700 feet, IX, 1919, (from A. Maria), 4 ♂, 9 ♀, *type, allotype, paratypes.*

Pacho, Cundinamarca, 5900 feet, III, 19, 1917, (from A. Maria), 2 ♂, 6 ♀, *paratypes.*

Choachi, Cundinamarca, 5900 feet, II and III, 1916, (from A. Maria), 5 ♂, 2 ♀.

Fómeque, Cundinamarca, 6074 feet, V, 1914, (from A. Maria), 1 ♂, 1 ♀.

Of the above localities the first two are in the Magdalena drainage, the last two in the Orinoco drainage.

PARAPIEZOPS new genus

We propose this genus to include *homalonotus*, a new species, and Stål's *Rhytidochrota varicolor*, described from Medellin, Antioquia. We select *homalonotus* as genotype.

The genus differs from *Piezops*[174] in the declivent and nonsulcate vertex, weakly ensiform antennae and shorter spines of the caudal tibiae. It agrees with that genus, however, differing from all others, in the more bulbously ascendant occiput, more strongly produced dorsal portion of the frontal costa with lateral carinae decidedly elevated, more prominent eyes, fastigium with apex broadly concave between the lateral carinae of the frontal costa, strong concavity of the face, rugulose pronotum, large

[174] Erected in the present paper to include the single Panamanian species, described by Stål as *Rhytidochrota ensicornis.*

and slender prosternal spine, conspicuously serrulate caudal femora both dorsad and ventrad in proximal portion, acute projection of the medio-dorsal carina of the same at its apex and in the third joint of caudal tarsi being distinctly longer than the combined length of the first two joints.

The following characters are, in addition, considered of generic value. Size large, form slender for the group. Interocular space of female moderately broad, not sulcate, decidedly broader than the narrow frontal costa.[175] Pronotum with inconspicuous transverse sulci; sellate, due to the narrow cephalic portion ascending to embrace the occiput. Mesosternum with interval between lobes distinctly transverse in female, the margins of the mesosternum and metasternum broadly rugose and granulose. Apterous. Large tympanum present. Caudal tibiae with seven or eight dorso-external spines, lacking a distal spine on this margin, the longest of these decidedly longer than the tibial width at its base, but decidedly shorter than in *Piezops*.

This insect is clearly an intermediate type of the same strain as the less specialized *Opaon* and the more specialized *Piezops*. So distinctive is this strain that Kirby, when describing *Opaon*, believed that a new family should be erected for its reception, failing to note that his species would have been included in *Rhytidochrota* as broadly defined by Stål.

Parapiezops homalonotus new species (Plate XVII, figures 7 and 8.)

This remarkably formed, though obscurely colored, insect may be readily separated from *P. varicolor* (Stål) by the non-tuberculate dorsal segments but strong rugose lamellation of the mesonotum and metanotum dorsad on each side and in the distal spine of the medio-dorsal carina of the caudal femora being as heavy as in *Piezops ensicornis* (Stål).

As both of the species referred to above are known to be subject to decided color variation, the same is probably true of *homalonotus*.

Type.— ♀ ; Andagoya, Antioquia (Chocó), Colombia. April 22, 1918. (M. A. Carriker, Jr.) [Hebard Collection, Type no. 906.]

[175] Closely resembling the type developed in this sex of *Opaon*.

We give the following features specific value, adding them to those discussed in the generic diagnosis. Size large, form slender for the group. General appearance rugulose but somewhat shining. Surface thickly rugose, this weakest on occiput; small areas caudad of and below eyes and interocular area smooth; surface becoming thickly pitted on mesonotum, metanotum and median segment, this weaker on the abdominal tergites. Vertex with very delicate, concave convergent, bounding carinae which are continued as the sublamellate lateral carinae of the narrow frontal costa. Frontal costa terminating at base of produced portion by a transverse sulcus, the lateral carinae of the face distinct above this, no carinae indicated on face below it. Eye longer than wide, very slightly longer than infra-ocular sulcus. Interocular width about twice that of the narrow frontal costa. Pronotum with disk weakly definable from lateral lobes, the very narrow metanotum showing a feeble, coarse medio-longitudinal carina, disk on each side between second and principal sulcus produced in a very small, rounded, granose ridge. Mesonotum and metanotum with heavy lateral granose ridges conspicuous, these projections likewise horizontal. Ovipositor comparatively small, moderately heavy, dorsal valves briefly curved at apex, ventral valves with ventral margin almost straight to apex. Sutures of external paginae of caudal femora sub-rugose, impresso-punctate and irregular. Caudal tibiae armed with eight spines.

General coloration dorsad and ventrad shining black with a chestnut tinge, paling to auburn on abdomen and dorsal surface of caudal femora. Eyes deep bay. Antennae of the general coloration proximad, gradually paling so that in distal portion they are ochraceous-tawny. Palpi ochraceous-buff. Cephalic and median limbs dull tawny. Caudal femora paling laterad to tawny and ventrad brightening to hays russet, ventro-internal surface nopal red. Caudal tibiae dull tawny, becoming buffy distad, the spines black.

Length of body, 29.3; greatest width of body, 7.6; length of antenna, 21; length of pronotum, 4.1; length of caudal femur, 20.8; greatest width of caudal femur, 3.9; length of longest caudal tibial spur, 1.3 mm.

The type of this extraordinary grasshopper is unique.

EXPLANATION OF PLATES

Plate X

Fig. 1.—*Lophotettix unicristatus* Hancock. Lateral view of female. Susumuco, Cundinamarca, Colombia. (× 4)

Fig. 2.—*Paratettix antennatus* new species. Dorsal view of male head and antennae. Andagoya, Antioquia (Chocó), Colombia. *Type.* (× 10)

Fig. 3.—*Paramastax poecilosoma* new species. Lateral view of male. La Sierra, Cauca, Colombia. *Type.* (× 4)

Fig. 4.—*Ommexecha apolinari* new species. Dorsal view of male head and pronotum. Cordillera la Quinta, Cundinamarca, Colombia. *Type.* (× 4)

Fig. 5.—*Taeniophora chocoensis* new species. Lateral view of female. Boca Murindo, Intendencia del Chocó, Colombia. *Type.* (× 2)

Fig. 6.—*Taeniophora dagua* new species. Lateral view of female. Jiminez, El Valle, Colombia. *Type.* (× 2)

Fig. 7.—*Ophthalmolampis valida* new species. Lateral view of female. Susumuco, Cundinamarca, Colombia. *Type.* (× 2)

Fig. 8.—*Hisychius nigrispinus* Stål. Dorsal view of female head and pronotum. Yurimaguas, Loreto, Peru. (× 2)

Fig. 9.—*Hisychius viridiventris* new species. Dorsal view of female head and pronotum. Muzo, Boyacá, Colombia. *Type.* (× 2)

Plate XI

Fig. 1.—*Acrydium andeanum* new species. Dorsal view of female head. La Pica, Santander, Colombia. *Type.* (× 10)

Fig. 2.—*Acrydium andeanum* new species. Lateral outline of female head. La Pica, Santander, Colombia. *Type.* (× 10)

Fig. 3.—*Batrachidea inermis* new species. Dorsal view of female head. Andagoya, Antioquia (Chocó), Colombia. *Type.* (× 10)

Fig. 4.—*Eumastax cerciata* new species. Lateral view of male cercus. Porto Bello, Panama. *Type.* (Greatly enlarged.)

Fig. 5.—*Eumastax cerciata* new species. Ventral outline of female subgenital plate. Porto Bello, Panama. *Paratype.* (Much enlarged.)

Fig. 6.—*Eumastax carrikeri* new species. Lateral view of male cercus. Andagoya, Antioquia (Chocó), Colombia. *Type.* (Same scale as Fig. 4.)

Fig. 7.—*Eumastax carrikeri* new species. Lateral view of caudal limb of male. Andagoya, Antioquia (Chocó), Colombia. Type. (× 4)

Fig. 8.—*Eumastax carrikeri* new species. Ventral view of female subgenital plate. Andagoya, Antioquia (Chocó), Colombia. *Allotype.* (Same scale as Fig. 5.)

Fig. 9.—*Eumastax apolinari* new species. Lateral view of male cercus. Susumuco, Cundinamarca, Colombia. *Type.* (Same scale as Fig. 4.)

Fig. 10.—*Santanderia lita* new species. Dorsal view of male pronotum. La Pica, Santander, Colombia. *Type.* (× 4)

Fig. 11.—*Santanderia lita* new species. Lateral view of male caudal femur. La Pica, Santander, Colombia. *Type.* (× 4)

Fig. 12.—*Santanderia lita* new species. Dorsal view of female pronotum. La Pica, Santander, Colombia. *Allotype.* (× 4)

Fig. 13.—*Santanderia lita* new species. Ventral outline of female subgenital plate. La Pica, Santander, Colombia. *Allotype.* (Same scale as Fig. 5.)

Fig. 14.—*Paramastax rosenbergi* (Burr). Dorsal outline of caudal margin of male penultimate tergite. La Cumbre, El Valle, Colombia. (Much enlarged.)

Fig. 15.—*Paramastax rosenbergi* (Burr). Dorso-lateral view of male cercus. La Cumbre, El Valle, Colombia. (Scale scale as Fig. 4.)

Fig. 16.—*Paramastax poecilosoma* new species. Dorsal outline of caudal margin of produced male penultimate tergite. La Sierra, Cauca, Colombia. *Type.* (Same scale as Fig. 14.)

Fig. 17.—*Paramastax poecilosoma* new species. Dorso-lateral view of male cercus. La Sierra, Cauca, Colombia. *Type.* (Same scale as Fig. 4.)

Fig. 18.—*Amblytropidia insignis* new species. Dorsal view of male vertex. Gatun, Canal Zone, Panama. *Type.* (Much enlarged.)

Fig. 19.—*Amblytropidia insignis* new species. Dorsal view of female vertex. Gatun, Canal Zone, Panama. *Allotype.* (Same scale as Fig. 18.)

Plate XII

Fig. 1.—*Caenomastax atopa* new species. Dorsal view of male pronotum and tegmina. Muzo, Boyacá, Colombia. *Type.* (× 4)

Fig. 2.—*Caenomastax atopa* new species. Lateral view of male cercus. Muzo, Boyacá, Colombia. *Type.* (Greatly enlarged, same scale as Plate XI, Fig. 4.)

Fig. 3.—*Caenomastax atopa* new species. Dorsal view of female pronotum and tegmina. Muzo, Boyacá, Colombia. *Allotype.* (× 4)

Fig. 4.—*Caenomastax atopa* new species. Ventral view of female subgenital plate. Muzo, Boyacá, Colombia. *Allotype.* (Much enlarged, same scale as Plate XI, Fig. 5.)

Fig. 5.—*Caenomastax insignis* new species. Dorsal view of male pronotum and tegmina. Muzo, Boyacá, Colombia. *Type.* (× 4)

Fig. 6.—*Caenomastax insignis* new species. Lateral view of male caudal femur. Muzo, Boyacá, Colombia. *Type.* (× 4)

Fig. 7.—*Caenomastax insignis* new species. Lateral view of male cercus. Muzo, Boyacá, Colombia. *Paratype.* (Same scale as Fig. 2.)

Fig. 8.—*Caenomastax insignis* new species. Dorsal view of female pronotum and tegmina. Muzo, Boyacá, Colombia. *Allotype.* (× 4)

Fig. 9.—*Caenomastax insignis* new species. Ventral view of female subgenital plate. Muzo, Boyacá, Colombia. *Allotype.* (Same scale as Fig. 4.)

Fig. 10.—*Prosarthria caucensis* new species. Dorsal outline of male head. Rio Cauca, Colombia. *Type.* (× 3)

Fig. 11.—*Prosarthria caucensis* new species. Lateral outline of male subgenital plate. Rio Cauca, Colombia. *Type.* (× 4)

Fig. 12.—*Proscopia aberrans* new species. Lateral view of male head. Villavicencio, Intendencia del Meta, Colombia. *Type.* (× 3)

Fig. 13.—*Proscopia aberrans* new species. Lateral outline of male caudal femur. Villavicencio, Intendencia del Meta, Colombia. *Type.* (× 1½)

Fig. 14.—*Cumarala annectens* new species. Dorsal outline of male. Pueblo Nuevo de Ocaña, Santander, Colombia. *Allotype.* (× 4)

Fig. 15.—*Cumarala annectens* new species. Dorsal view of female vertex. Cumaral, Intendencia del Meta, Colombia. *Type.* (Much enlarged.)

Fig. 16.—*Cumarala annectens* new species. Outline of apex of female tegmen. Cumaral, Intendencia del Meta, Colombia. *Type.* (× 3)

Fig. 17.—*Orphulella melanopleura* new species. Dorsal view of male head and pronotum. Andagoya, Antioquia (Chocó), Colombia. *Type.* (× 5)

Plate XIII

Fig. 1.—*Compsacris aspasma* new species. Dorsal view of male vertex Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia *Type.* (Much enlarged.)

Fig. 2.—*Compsacris aspasma* new species. Dorsal view of female vertex. Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. *Allotype.* (Same scale as Fig. 1.)

Fig. 3.—*Scyllina alticola* new species. Dorsal view of male vertex. Taquina, Sierra Nevada de Santa Marta, Magdalena, Colombia. *Type.* (Much enlarged.)

Fig. 4.—*Scyllina alticola* new species. Outline of internal spurs of male caudal tibia. Taquina, Sierra Nevada de Santa Marta, Magdalena, Colombia. *Type.* (Greatly enlarged.)

Fig. 5.—*Agriacris brunnea* new species. Dorsal outline of male. Las Mesitas, Cundinamarca, Colombia. *Type.* (× ½)

Fig. 6.—*Draconata mancus* Pictet and Saussure. Dorsal view of male head and pronotum. La Palmeta, Santander, Colombia. (× 2)

Fig. 7.—*Colpolopha simplex* new species. Dorsal outline of female. Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. *Type.* (× 1½)

Fig. 8.—*Colpolopha metae* new species. Dorsal outline of male. Villavicencio, Intendencia del Meta, Colombia. *Allotype.* (× 1½)

Fig. 9.—*Colpolopha metae* new species. Lateral outline of female. Villavicencio, Intendencia del Meta, Colombia. *Type.* (× 1½)

Fig. 10.—*Dicaearchus eumera* new species. Dorsal view of female vertex. Probably Cali, El Valle, Colombia. *Allotype.* (Much enlarged.)

Fig. 11.—*Dicaearchus eumera* new species. Lateral view of male cercus. Cali, El Valle, Colombia. *Type.* (Greatly enlarged.)

Plate XIV

Fig. 1.—*Dicaearchus eumera* new species. Lateral view of male. Cali, El Valle, Colombia. *Type.* (× 3)

Fig. 2.—*Oxyblepta eumera* new species. Dorsal view of male head and pronotum. Andagoya, Antioquia (Chocó), Colombia. *Type.* (× 4)

Fig. 3.—*Phaeoparia carrikeri* new species. Lateral view of male. Cordoba, El Valle, Colombia. *Type.* (× 2)

Fig. 4.—*Phaeoparia amblyceps* new species. Lateral view of female. Susumuco, Cundinamarca, Colombia. *Type.* (× 2)

Fig. 5.—*Aristia bicolor* new species. Lateral view of female. Las Mesitas, Cundinamarca, Colombia. *Paratype.* (× 4)

Fig. 6.—*Aristia oxycodia* new species. Lateral view of male. La Cumbre, El Valle, Colombia. *Type.* (× 2)

Fig. 7.—*Oulenotacris hesperus* new species. Dorsal view of male. Susumuco, Cundinamarca, Colombia. *Type.* (× 2)

Fig. 8.—*Sitalces apolinari* new species. Dorsal view of female. Muzo, Boyacá, Colombia. *Type.* (× 3)

Fig. 9.—*Schistocerca boyacae* new species. Dorsal view of female head and pronotum. Muzo, Boyacá, Colombia. *Type.* (× 2)

Fig. 10.—*Schistocerca diversipes* new species. Lateral view of female pronotum. Macotama Valley above San Miguel, Sierra Nevada de Santa Marta, Magdalena, Colombia. *Type.* (× 2)

Fig. 11.—*Schistocerca diversipes* new species. Dorsal view of female tegmen. Macotama Valley above San Miguel, Sierra Nevada de Santa Marta, Magdalena, Colombia. *Type.* (Natural Size.)

Plate XV

Fig. 1.—*Leptysma perlonga* new species. Dorsal view of male vertex. Maripa, Rio Caura, Venezuela. *Type.* (× 5)

Fig. 2.—*Leptysma perlonga* new species. Lateral view of distal portion of male abdomen. Maripa, Rio Caura, Venezuela. *Type.* (Much enlarged.)

Fig. 3.—*Opshomala fissicauda* (Bruner). Lateral view of distal portion of male abdomen. Paramaribo, Dutch Guiana. (Much enlarged.)

Fig. 4.—*Opshomala fissicauda* (Bruner). Dorso-caudal view of apex of male abdomen. Paramaribo, Dutch Guiana. (Same scale as Fig. 3.)

Fig. 5.—*Opshomala colombiae* (Bruner). Lateral view of distal portion of male abdomen. Don Diego, Magdalena, Colombia. *Type.* (Same scale as Fig. 3.)

Fig. 6.—*Opshomala colombiae* (Bruner.) Caudal view of apex of male abdomen. Don Diego, Magdalena, Colombia. *Type.* (Same scale as Fig. 3.)

Fig. 7.—*Opshomala chocoensis* new species. Lateral view of distal portion of male abdomen. Boca Murindó, Intendencia del Chocó, Colombia. *Type.* (Same scale as Fig. 3.)

Fig. 8.—*Opshomala chocoensis* new species. Caudal view of apex of male abdomen. Boca Murindó, Intendencia del Chocó, Colombia. (Same scale as Fig. 3.)

Fig. 9.—*Poecilocloeus santamartae* new species. Caudal view of distal portion of male cercus. Hacienda Cincinnati, Sierra San Lorenzo, Magdalena, Colombia. *Type.* (Greatly enlarged.)

Fig. 10.—*Phaeoparia carrikeri* new species. Dorsal outline of distal portion of male tegmen. Córdoba, El Valle, Colombia. *Type.* (× 5)

Fig. 11.—*Phaeoparia carrikeri* new species. Dorsal view of distal portion of male abdomen. Córdoba, El Valle, Colombia. *Type.* (Much enlarged.)

Fig. 12.—*Phaeoparia carrikeri* new species. Dorsal outline of distal portion of female tegmen. Córdoba, El Valle, Colombia. *Allotype.* (× 5)

Fig. 13.—*Phaeoparia amblyceps* new species. Dorsal view of female vertex. Susumuco, Cundinamarca, Colombia. *Type.* (Much enlarged.)

Fig. 14.—*Aristia bicolor* new species. Dorsal view of female vertex. Las Mesitas, Cundinamarca, Colombia. *Paratype.* (Same scale as Fig. 13.)

Fig. 15.—*Aristia oxycodia* new species. Dorsal view of male vertex. La Cumbre, El Valle, Colombia. *Type.* (Same scale as Fig. 13.)

Fig. 16.—*Aristia oxycodia* new species. Dorsal view of female vertex. La Cumbre, El Valle, Colombia. *Allotype.* (Same scale as Fig. 13.)

Fig. 17.—*Psiloscirtus splendidus* new species. Lateral outline of male caudal femur. Susumuco, Cundinamarca, Colombia. *Type.* (× 2¾)

Fig. 18.—*Psiloscirtus splendidus* new species. Lateral view of male cercus. Susumuco, Cundinamarca, Colombia. *Type.* (Greatly enlarged.)

Fig. 19.—*Schistocerca diversipes* new species. Lateral view of male cercus. Taquina, Macotama Valley, Sierra Nevada de Santa Marta, Magdalena, Colombia. *Allotype.* (Much enlarged.)

Plate XVI

Fig. 1.—*Psiloscirtus splendidus* new species. Lateral view of female. Susumuco, Cundinamarca, Colombia. *Allotype.* (× 3)

Fig. 2.—*Chibchacris casenare* new species. Lateral view of male cercus. Palmar, Rio Casenare, Boyacá, Colombia. *Type.* (Greatly enlarged.)

Fig. 3.—*Chibchacris casenare* new species. Caudal view of apex of male subgenital plate. Palmar, Rio Casenare, Boyacá, Colombia. *Type.* (Greatly enlarged.)

Fig. 4.—*Chibchacris casenare* new species. Dorsal view of female. Palmar, Rio Casenare, Boyacá, Colombia. *Allotype.* (× 3)

Fig. 5.—*Chibchacrcis digitifera* new species. Lateral view of male cercus. La Pica, Santander, Colombia. *Type.* (Same scale as Fig. 2.)

Fig. 6.—*Chibchacris digitifera* new species. Caudal view of apex of male subgenital plate. La Pica, Santander, Colombia. *Type.* (Same scale as Fig. 3.)

Fig. 7.—*Chibchacris digitifera* new species. Dorsal view of female. La Pica, Santander, Colombia. *Allotype.* (× 3)

Fig. 8.—*Chibchacris furcata* new species. Lateral view of male cercus. La Pica, Santander, Colombia, *Type.* (Same scale as Fig. 2.)

Fig. 9.—*Chibchacris furcata* new species. Caudal view of apex of male subgenital plate. La Pica, Santander, Colombia. *Type.* (Same scale as Fig. 3.)

Fig. 10.—*Chibchacris furcata* new species. Dorsal view of female. La Pica, Santander, Colombia. *Allotype.* (× 3)

Fig. 11.—*Agesander ruficornis* Stål. Lateral view of male. Bogotá, Cundinamarca, Colombia. (× 3)

Fig. 12.—*Agesander ruficornis* Stål. Lateral view of male cercus. Bogotá, Cundinamarca, Colombia. (Same scale as Fig. 3.)

Plate XVII

Fig. 1.—*Rhytidochrota polia* new species. Lateral view of male. La Palmeta, Santander, Colombia. *Type.* (× 2½)

Fig. 2.—*Rhytidochrota polia* new species. Dorsal view of female. La Palmeta, Santander, Colombia. Allotype. (× 2½)

Fig. 3.—*Muyscacris panchlora* new species. Dorsal view of female. Cali, El Valle, Colombia. *Type.* (× 2½)

Fig. 4.—*Muyscacris panchlora* new species. Profile of fastigial production of female. Cali, El Valle, Colombia. *Type.* (× 3)

Fig. 5.—*Opaonella tenuis* new species. Lateral view of male. Muzo, Boyacá, Colombia. *Type.* (× 2½)

Fig. 6.—*Opaonella tenuis* new species. Dorsal view of female. Muzo, Boyacá, Colombia. *Allotype.* (× 2½)

Fig. 7.—*Parapiezops homalonotus* new species. Dorsal view of female. Andagoya, Antioquia (Chocó), Colombia. *Type.* (× 2½)

Fig. 8.—*Parapiezops homalonotus* new species. Profile of fastigial production of female. Andagoya, Antioquia (Chocó), Colombia. *Type.* (× 3)

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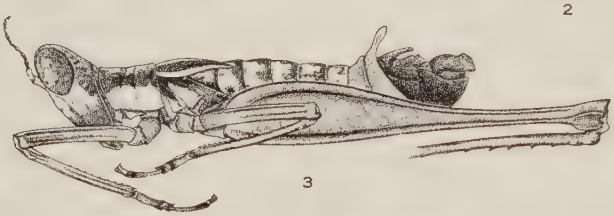

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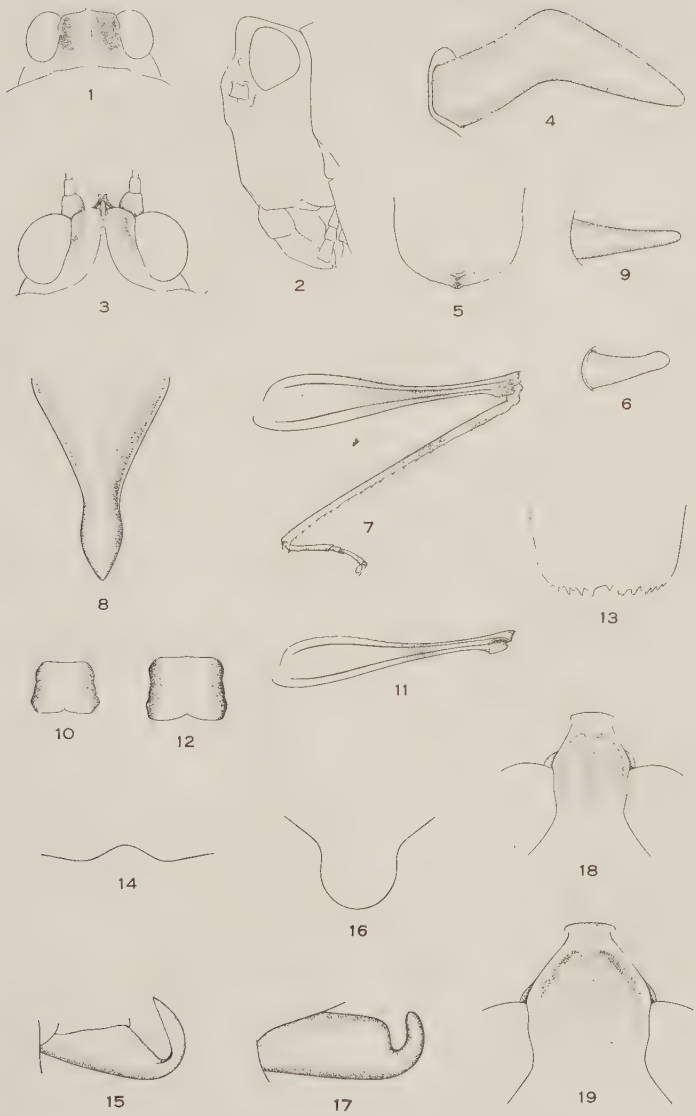
HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA



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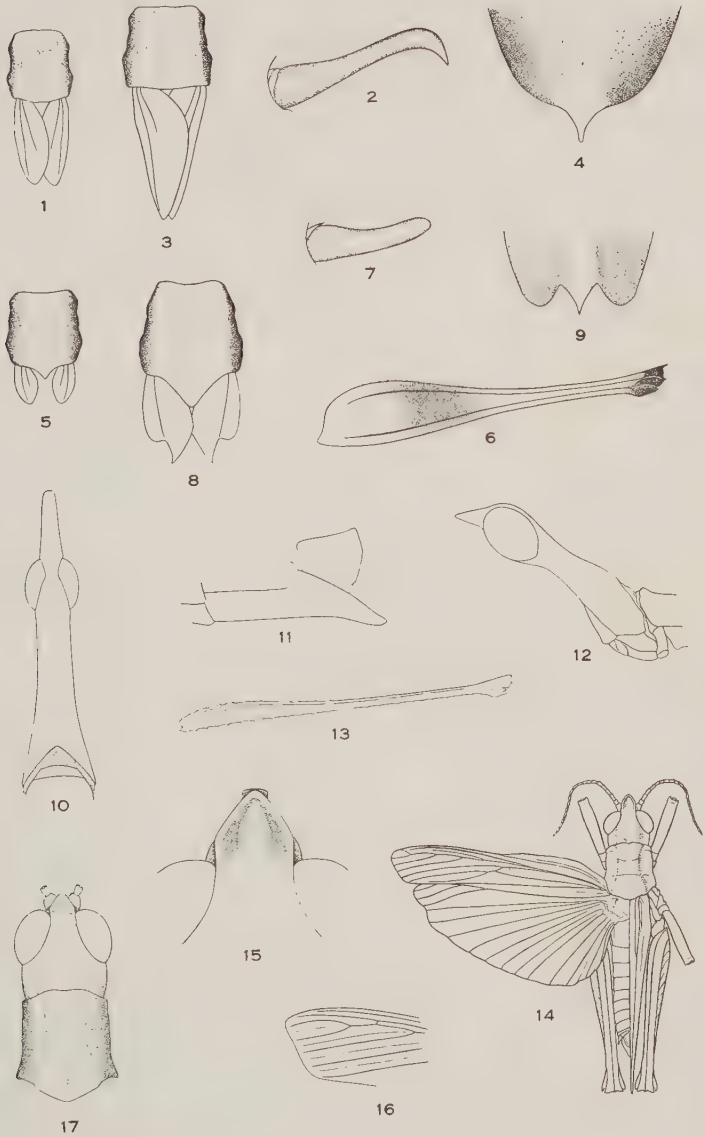

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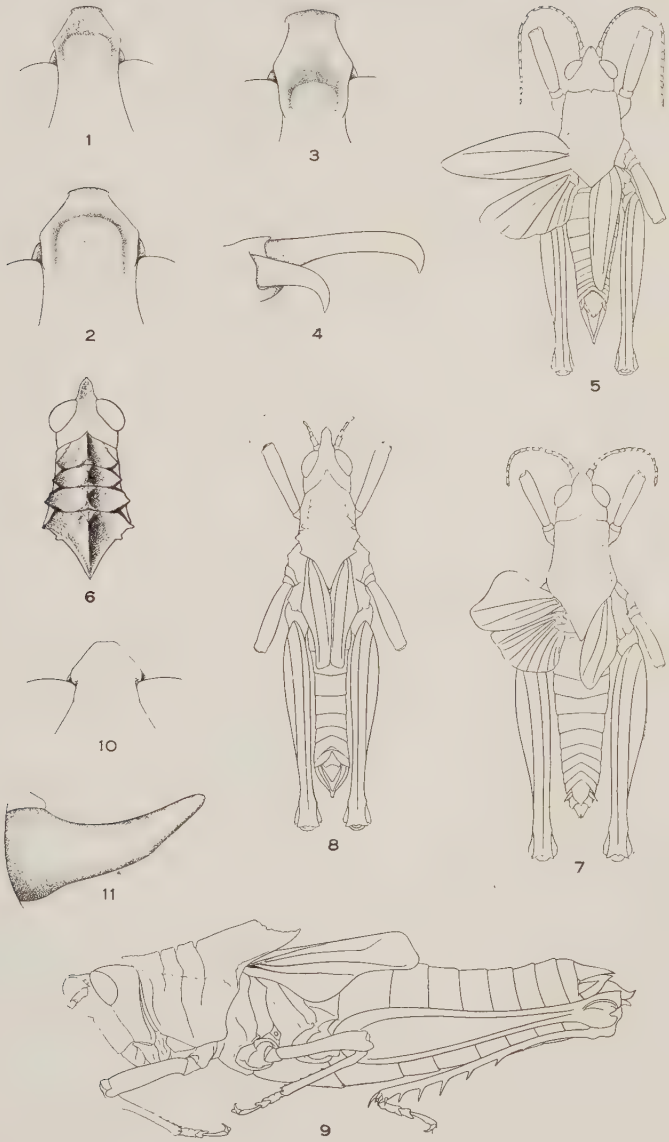

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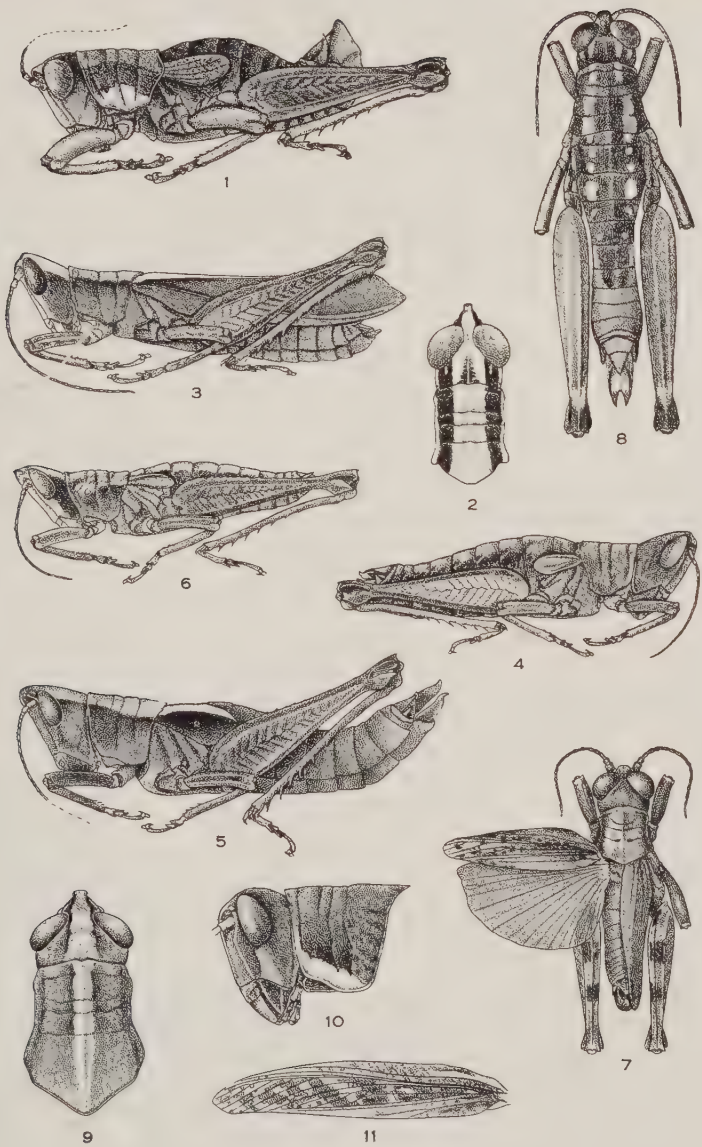

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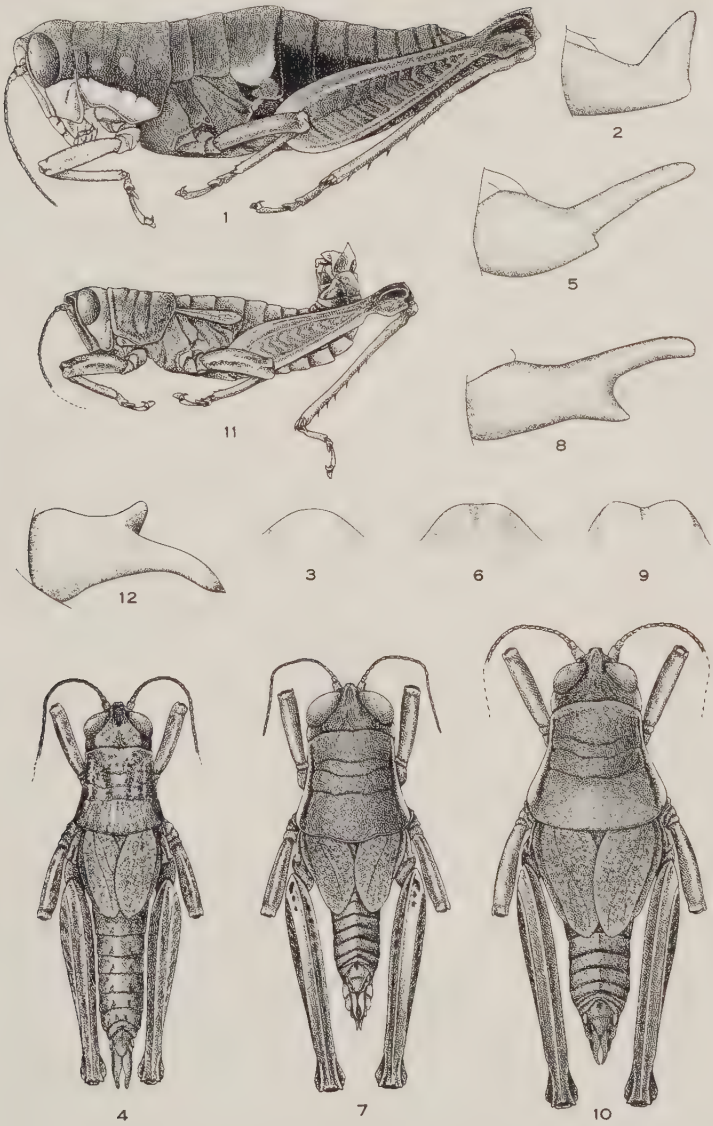
HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA



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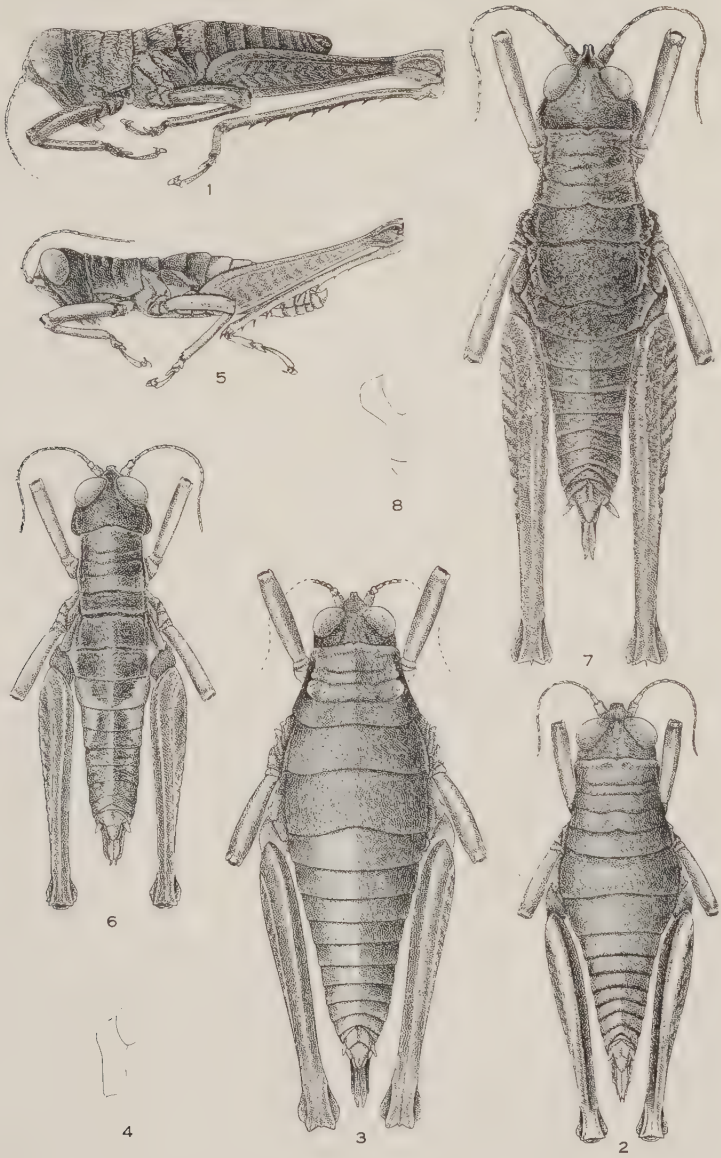

HEBARD—COLOMBIAN DERMAPTERA AND ORTHOPTERA

STUDIES IN THE MELYRIDAE (COLEOPTERA)

NUMBER TWO

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Studies in the Melyridae, Number One, appeared in the Canadian Entomologist of January, 1921. Species which cannot be referred to those already described are constantly coming to hand. In the present contribution to Science a number of non-descripts have been given names: one species of *Eudasytes* with a synoptic table; fourteen species of *Trichochrous;* one species of *Cradytes*, and a synoptic table. A complete and revised synoptic table of the species of *Trichochrous* is under way and as soon as the undescribed species are made known, it will be completed. Col. Casey's contributions to the knowledge of the Melyridae have stood the test of time and has only to be modified to permit of the interpolation of the new species.

Description of New Species

Eudasytes desertus new species

Form oblong, slightly narrowed anteriorly, moderately convex, about a third longer than wide. Color black; basal joints of the antennae, mouth-parts, apical third of tibiae, more or less rufopiceous; tarsi more or less rufous. Surface shining, pronotal disk somewhat polished.

Pubescence sparse and luteo-cinereous in color, nearly recumbent, laterally on the declivous sides of the elytra some of the paler hairs are semi-erect; sparsely intermixed on the upper surface with longer and more or less erect blackish hairs, these are stiffer, more irregular on the head and pronotum, not forming a regular and close-set fringe on the pronotal side margins. Fimbriae of the elytral margins pale, sparsely intermixed near the humeri with blackish hairs. The body beneath is clothed with pale and rather fine recumbent hairs.

Head very sparsely punctate and smooth; surface flat, very feebly and broadly bi-impressed anteriorly. Antennae moderately stout, not serrate; fifth joint triangular, wider than the fourth, scarcely wider than the sixth; ninth and tenth feebly transverse.

Pronotum rather transversely oblong, about a half wider than long; sides parallel, feebly and broadly sinuate before the basal angles, thence feebly and broadly arcuate to the apex, the latter broadly and moderately deeply emarginate between the rather broad, anteriorly prominent and obtusely rounded angles, the emargination is quite transverse at bottom; base broadly arcuate, feebly sinuate in lateral fifths; basal angles obtusely rectangular; disk very moderately convex, very sparsely punctate, punctures small and separated by a distance equal to three or four times their diameter, interstices smooth throughout.

Elytra oblong, about a third longer than wide, broadly and evenly rounded at apex; sutural angles evenly rounded; sides parallel, scarcely arcuate, margin slightly explanate; disk feebly convex on the dorsum, arcuately declivous at the sides, rather abruptly so at the humeri, the latter obtusely subrectangular; humeral umbone rather large; surface not closely punctured, punctures small, surface more or less rugulose. Scutellum as long as wide and obtusely rounded at apex.

Abdomen very finely punctate.

Male.—Sides rather more parallel, fifth ventral segment arcuato-truncate at apex.

Female.—Elytra slightly broader than the pronotum; sides slightly arcuate. Abdomen more convex, fifth ventral longer and strongly rounded at apex.

Measurements.—Length (types), 3 to 3.5 mm.; width, 1.3 to 1.6 mm.

Type, male, and *allotype*, female, as well as paratypes, in my own collection. A paratype will be placed in the collection of the California Academy of Sciences and in that of the American Entomological Society in Philadelphia, as well as in that of the United States National Museum in Washington, D. C.

Type locality.—The male type was collected at Isabella, Kern County, California, on June 5, 1913. The allotype and paratypes were secured at Mojave, Kern County, California, on June 1, 1917.

Desertus can be separated from *amplus* Casey and *oblongus* Casey by its dark legs; by its pale vestiture from *ursinus* Casey and *hirsutus* Blaisdell. Both *reynoldsi* Blaisdell and *grandicollis* Blaisdell are larger and have the pronotal apical angles markedly prominent anteriorly and more acute. Many specimens of *desertus* have a more or less aeneous luster.

Synoptic Table of the Species of Eudasytes Casey

Vestiture blackish throughout 1
Vestiture pale; legs more or less rufous 2

1. Apical angles feebly produced anteriorly, rounded and deflexed; basal angles slightly obtuse, distinct and not rounded; sides of the pronotum slightly convergent anteriorly. (Southern California) ..... *ursinus* Casey
   Apical angles broad and rounded, not deflexed; basal angles rectangular and slightly prominent laterally; sides of the pronotum parallel. (Nevada) *hirsutus* Blaisdell

2. Basal angles of the pronotum prominent laterally 3
   Basal angles not prominent laterally 4

3. Basal angles large, acute, divergent, and prominent posteriorly; humeri broadly dentiform, pronotum large (male). Female less strongly developed. (Arizona) ..... *reynoldsi* Blaisdell
   Basal angles nearly rectangular, not rounded, distinctly prominent laterally. (Utah) ..... *oblongus* Casey

4. Legs pale throughout; prothorax large 5
   Legs partly piceous; head and pronotum with erect black setae; apical pronotal angles broadly and anteriorly prominent and obtusely rounded in both sexes. (Kern County, California) ..... *desertus* new species

5. Erect setae of the elytra short; apical pronotal angles right and scarcely at all rounded; basal angles obtuse and not at all rounded (female). (California) ..... *amplus* Casey
   Erect setae moderately long; apical angles anteriorly prominent, subacute and deflexed; basal angles obtusely rounded (female), adjacent surface of the pronotal disk impressed in both sexes. (Nevada) *grandicollis* Blaisdell

Eudasytes is a valid genus and is characterized as follows: Form broad and oblong, pronotum transversely oblong with the angles usually well developed; epipleura comparatively broad, horizontal and nearly or quite attaining the elytral apex, and with their surface plane inward at apex, sometimes remaining horizontal throughout.

In *Trichochrous* the epipleura are much narrower and have their surface plane turned outward at apex, sometimes remaining horizontal to point of termination.

Trichochrous pratensis new species

Form elongate oblong, subparallel, slightly narrowed anteriorly. Color piceous black; legs, anal segment beneath and fifth ventral more or less pale ferruginous; elytral apex more or less similarly pale. Antennae pale, distal joints blackish, others more or less black on their anterior angle. Color variable, sometimes nearly ferruginous throughout; prothorax alone pale at times.

Pubescence sparse and semi-recumbent, hairs slender and lance-like, even in distribution, pale in color; fimbriae whitish and moderate in length.

Head subtriangular, sides rather rapidly converging in front of the eyes, the latter moderately prominent and evenly convex; front flat, evenly and sparsely punctate, punctures small. Antennae stout, moderate in length, extending to base of the prosternum.

Pronotum about as long as wide; apex scarcely arcuate in circular arc; base broadly but not strongly arcuate; sides broadly and feebly arcuate, slightly convergent anteriorly, marginal bead fine; angles subequally and broadly rounded; disk strongly and evenly convex from side to side, finely and very sparsely punctate; lateral fimbriae moderately short and quite even.

Elytra oblong, about a half longer than wide, moderately convex; sides feebly arcuate and parallel, apex arcuato-truncate, sutural angles acute and slightly produced; disk finely and sparsely punctate, surface somewhat finely impressed about the punctures; humeri slightly prominent and rounded.

Legs moderate in length; tarsi rather stout.

Male.—Narrower; fifth ventral abdominal segment apparently sinuato-truncate at apex; genital segment rather deeply excavated.

Female.—Broader; fifth ventral broadly rounded at apex.

Measurements.—Length (types), 2.3 to 2.6 mm.; width, 1 to 1.2 mm.

Type, male, and *allotype*, female, in my own collection. Paratypes in the collection of Mr. Warren Knaus and in that of my own. A paratype will also be deposited in the collection of the American Entomological Society, Philadelphia.

Type locality.—Ash Meadows, Nye County, Nevada. Collected August 14 to 19, 1921, by Mr. Warren Knaus while on the Nininger-Hoover Expedition. A series of fourteen specimens studied.

Pratensis belongs to the group of small species having the body clothed with subdecumbent hairs without intermixed erect setae, and the elytral pubescence uniform in structure and distribution; color pale or bicolored. It falls near *innocens* according to Casey's table.

Trichochrous tinctipes new species

Form oblong-oval and convex. Color black and shining; basal joints of the antennae more or less rufous, remaining joints rufo-piceous; femora bright rufous, tibiae and tarsi dark rufous. Surface of head and pronotum polished.

Pubescence consisting of moderately long cinereous hairs which are quite decumbent, intermixed abundantly with long, black, erect hispid and bristling hairs. The latter are very irregularly directed and abundant on the pronotal disk, on the head less so. Paler hairs of the elytra not dense nor hiding the general surface; on the pronotum longer and coarser and not forming a regular lateral fringe; on the under surface of the body grayish and recumbent; quite dense on the meso- and metasternum, on abdomen darker, shorter and less abundant. Elytral fringe very long, dark and rather widely spaced; disk with dark brown hairs forming an indefinite area in basal fourth, and which is not always discernible. Pronotal fimbriae coarse, long, irregular and not close set.

Head moderate in size, width across the eyes equal to that of the pronotal apex; front very slightly convex or feebly and broadly bi-impressed between the antennae, very sparsely punctate, punctures moderately small and separated by a distance equal to three to five times their diameter, becoming rather abruptly denser on the occiput and tempora, interstices flat and glabrous; epistoma impunctate at middle and rather coarsely punctate laterally, apical border narrowly pale. Eyes rather large and moderately prominent. Antennae stout and subserrate.

Pronotum rather large, transversely suboblong, about a third wider than long, not wider than the elytra; apex broadly and feebly emarginate in circular arc, margin with a row of coarse punctures; sides broadly and moderately arcuate, converging feebly toward apex, marginal bead coarse and moderately reflexed, especially toward base; apical angles obtuse and narrowly rounded and somewhat prominent anteriorly; base feebly and broadly arcuate, about a fifth wider than the apex and very coarsely margined; basal angles strong, obtuse, rather broadly

and feebly reflexed, strongly beaded; disk strongly and evenly convex, feebly so antero-posteriorly, impressed within the angles, very sparsely punctate, punctures sharply defined, moderately small, interstices flat and glabrous throughout with some evidence of a narrow median impunctate line in middle third.

Elytra oblong, parallel, broadly rounded at apex, less than twice as long as wide; feebly impressed at basal fourth and within the humeral umbones; humeri obtusely rounded; punctures larger than on the pronotum, rather shallow and separated by a distance equal to two or three times their diameter, finer toward apex; surface more or less feebly rugulose.

Abdomen rather densely punctulato-rugulose; pubescence abundant. Legs moderate in stoutness and length.

Male.—Larger than the female in the series at hand. Prothorax large, strongly convex, often denuded of hairs and highly polished; antennae stout. Fifth abdominal segment sinuato-truncate at apex.

Female.—Smaller. Prothorax slightly smaller, less strongly convex; also frequently denuded and glabrous. Antennae rather less stout. Fifth ventral segment rather strongly rounded at apex.

Measurements.—Length (types), 4.5 to 4 mm.; width, 1.7 to 1.5 mm.

Type, male, and *allotype*, female, in my own collection. Paratypes in Mr. J. O. Martin's collection and that of my own, also one in that of the American Entomological Society, Philadelphia. Eighteen specimens studied. Mr. Martin collected the series on July 10, 1919.

Type locality.—Bear Lake, San Bernardino County, California.

Tinctipes is a fine species and apparently distinct from anything yet described. It evidently belongs to Casey's third group, and from the color of the pubescence and even distribution, it resembles *aenescens*, which has black legs, or *pedalis* a smaller species with red legs. If the pubescence can be called unevenly distributed it would have to be placed near *curticollis*, which likewise has red legs and two black discal spots on each elytron. In all probability it is most closely related to the latter species and should therefore follow it in our lists.

Trichochrous palpalis new species

Form oblong-oval and moderately convex, less than three times as long as wide. Color deep black; tibiae and tarsi clear rufous; basal joints of antennae and mouth parts more or less rufous. Surface polished and with a slight aeneous luster.

Pubescence dual, consisting of semi-erect and of bristling hairs. Semi-erect hairs brownish or brownish-gray in color, rather long and slightly coarse, very sparse. Bristling hairs black, erect, long and coarse. Marginal cilia of the sides of the pronotum black, those of the elytra gray.

Head about four-fifths as wide as the pronotum; frontal impressions broad and shallow, separated by a feebly convex area near the epistomal base; surface coarsely and distinctly reticulate, occiput densely so; punctures sparse, well defined and moderate in size. Eyes moderately prominent. Antennae with the outer joints incrassate.

Pronotum about a half wider than long; sides broadly and more or less evenly arcuate from apex to base, or straighter anteriorly and posteriorly, and subangulate just behind the middle; apex arcuato-truncate, apical angles rounded but not broadly so; base broadly arcuate and continuous with the broadly rounded basal angles; disk moderately convex, punctures very sparse and sharply defined in the central two-fourths with the interstices smooth and polished, lateral fourths coarsely and distinctly reticulate.

Elytra oblong and nearly parallel, about twice as long as wide; humeri rather prominent, smooth and shining; apex rather broadly and evenly rounded, sutural angles rounded separately; punctures rather coarse and unevenly distributed; surface somewhat transversely rugose between the almost transversely arranged punctures, the latter finer and the surface smoother toward apex.

Abdomen finely and densely punctate; cinereous hairs abundant and recumbent.

Male.—Narrower; pronotum slightly wider than the elytra, with sides sometimes subangulate; antennae stouter. Fifth ventral abdominal segment sinuato-truncate at apex, surface opposite to the sinuation impressed; impression glabrous and with two or three scattered punctures, at the periphery of the impression the punctures are noticeably denser and the hairs more numerous.

Female.—Broader; elytra slightly wider than the pronotum, sides of latter broadly and evenly arcuate. Fifth ventral broadly and not very strongly arcuate at apex.

Measurements.—Length (types), 2.9 to 3.1 mm.; width, 1 to 1.1 mm.

Type, male, and *allotype,* female, in my own collection. Paratypes in my own and Mr. J. O. Martin's collection, as well as that of American Entomological Society of Philadelphia.

Type locality and habitat.—Bear Lake, San Bernardino County, California. Types were collected on May 3 and June 6, 1919, by Mr. Martin. Twenty-six specimens studied.

At first sight *palpalis* greatly resembles *aenescens* Casey. I have before me typical *aenescens* taken on the Island of Santa Cruz off the coast of southern California; these specimens answer absolutely to Casey's description and the pronotal disk is not at all rugose laterally, besides the fifth ventral segment in the male is simply truncate at apex.

In *palpalis* the front of the head and sides of the pronotal disk in lateral fourth are coarsely and distinctly reticulate, the fifth ventral in the male is sinuato-truncate at apex and the adjacent surface modified; marginal cilia of the elytra whitish and those of the pronotum black. *Palpalis* should follow *sexualis* Casey in our lists.

Trichochrous vanduzeei new species

Form elongate, parallel and moderately convex. Color deep black; surface polished and shining and with a slight purpureo-aeneous luster; tarsi slightly rufo-piceous.

Pubescence black to brownish, sparse; shorter hairs more or less semi-erect, intermixed with long and more or less erect hairs; along the declivous sides of the elytral disk the shorter hairs may be slightly grayish; on the head and pronotum the hairs are longer and more bristling. Pronotal and elytral fimbriae quite long and not forming a regular close-set fringe.

Head subequal in width to the pronotal apex; front flattened, impressions broad and shallow; punctures moderately fine, sparse, and the surface longitudinally rugulose against the eyes. Muzzle triangular and rather short.

Pronotum about a third wider than long; sides parallel and broadly arcuate, more strongly so towards the base, less so

anteriorly and moderately convergent to apex, the latter arcuato-truncate; apical angles obtuse and moderately rounded; base broadly arcuate; basal angles broadly rounded with the sides and base; disk moderately convex, punctures rather coarse and separated by a distance equal to about twice their diameter; surface distinctly reticulato-punctate laterally.

Elytra less than twice as long as wide, parallel; disk rather strongly declivous laterally, margins only moderately reflexed, punctures rather coarse and separated by a distance equal to about twice their diameter; surface very finely crinkled. Humeri rather prominent. Scutellum pubescent.

Abdomen densely punctured, punctures rather fine; pubescence somewhat grayish.

Male.—Fifth ventral abdominal segment distinctly emarginate, sinus moderately broad, bottom of which is transverse, and the lateral lobes broadly arcuate; surface anterior to the sinus feebly impressed and more or less slightly glabrous, pubescence unmodified; pygidium horizontal and densely punctate, margin densely clothed with black hairs.

Female.—Fifth ventral broadly rounded at apex.

Measurements.—Length (types), 3.1 to 4.0 mm.; width, 1.4 to 1.6 mm.

Type, male, and *allotype*, female, in the collection of the California Academy of Sciences. Paratypes in the California Academy's collection and in that of my own, as well as one in that of the American Entomological Society in Philadelphia.

Type locality.—Salada Beach, San Mateo County, California. Types collected on April 21, 1921, by Mr. E. P. Van Duzee, to whom I take pleasure in dedicating the species.

Vanduzeei has also been taken at Bryson, Monterey County, California, on April 26. It should follow *palpalis* in the list of species. The above two species make an interesting addition to the group of species in which the fifth ventral abdominal segment shows sexual modification.

Trichochrous instabilis new species

Form oblong-oval, moderately convex. Color black; legs bright rufous; basal joints of antennae and mandibles more or less rufous; surface rather shining.

Pubescence pale, flavo-argenteous in color, moderately short, evenly distributed, not dense and not completely hiding the surface, recumbent and without any erect hairs; slightly longer on the head and pronotum. Fimbriae of the pronotal sides rather short and backwardly curved and not conspicuous. Marginal fimbriae of the elytra rather long and somewhat widely spaced.

Head about two-thirds as wide as the pronotum; front broadly and feebly bi-impressed, punctures moderately small, sparse and rather evenly distributed. Eyes moderately large, not very prominent and finely setulose.

Pronotum moderately transverse, a little less than a half wider than long; apex broadly and feebly arcuate, a little narrower than the base; the latter broadly arcuate in middle three-fifths, thence broadly and not strongly sinuate to the more or less rounded or subobtuse basal angles; sides parallel, moderately evenly arcuate; apical angles obtusely rounded; disk evenly but not strongly convex, punctures moderately small, rather sparse, separated by a distance equal to two or three times their diameter, intervals smooth and shining.

Elytra oblong, sides parallel, very slightly arcuate, almost semicircularly rounded at apex; punctures moderately small, about equal to those of the pronotum and similarly spaced, finer apically; surface very finely microscopically rugulose.

Abdomen rather finely and closely punctate.

Male.—Usually smaller and narrower than the female. Antennae somewhat stouter. Fifth ventral abdominal segment sinuato-truncate.

Female.—Larger and slightly broader. Fifth ventral abdominal segment arcuate at apex.

Measurements.—Length (types), 2 to 2.2 mm.; width, .9 to 1.9 mm.

Type, female, and *allotype*, male, in my own collection. Paratypes in my own and Mr. J. O. Martin's collection. A paratype will also be placed in the American Entomological Society's collection, Philadelphia.

Type locality.—Bear Lake, San Bernardino County, California. Twenty specimens studied; collected June 5, 1919.

According to Casey's synoptic table *instabilis* is related to *discipulus* and *caseyi*, and belongs to the group of species clothed

with subdecumbent hairs, without trace of intermixed erect setae. The four species of the group that have the sides of the pronotum parallel or very nearly so are *fulvotarsis* Bland, *antennatus* Motschulsky, both from near San Francisco and well known, *discipulus* Casey and *caseyi* Champion. In the last two the thoracic cilia are long and not fimbriform and the legs are more or less dark. In *instabilis* the legs are clear rufous and the pronotal cilia are distinctly fimbriform and rather short. It should precede *discipulus* in the list.

Trichochrous borealis new species

Form oblong-oval to ovate, convex. Color black and more or less shining; tibiae and tarsi sometimes dark rufo-piceous, antennae paler toward base.

Pubescence moderately long, rather coarse, quite dense and cinereous in color; some of the hairs at the sides of the elytra appear to be semi-erect; lateral cilia of the pronotum, moderately long and fimbriform, those of the elytral sides longer and similar.

Head across the eyes about as wide as the pronotal apex; front flat, broadly and rather deeply impressed—almost bi-impressed; epistomal region nearly impunctate, elsewhere the punctures are sparse.

Pronotum transverse, about a third wider than long; sides quite broadly arcuate, moderately convergent anteriorly; apex arcuato-truncate, angles rather broadly rounded; base broadly arcuate, angles subobtuse and more or less distinct; disk evenly convex from side to side, punctures sparse, rather strong and moderate in size, separated by a distance equal to two or three times their diameter, interspaces glabrous, punctures somewhat denser laterally.

Elytra less than twice as long as wide; sides more or less parallel, margins not conspicuous and narrow; disk slightly depressed especially toward base, rather densely punctate, punctures rather smaller than on the pronotum; surface very finely wrinkled; apex broadly rounded.

Abdomen rather densely and finely punctate.

Male.—Fifth ventral abdominal segment quite truncate at apex.

Female.—Fifth ventral segment very broadly arcuate at apex.

Measurements.—Length (types), 2.8 to 3.3 mm.; width, 1.2 to 1.4 mm.

Type, male, and *allotype,* female, in the collection of the California Academy of Sciences; collected by Mr. E. P. Van Duzee on July 31, 1918. Two paratypes in my own collection.

Type locality.—Colestin, Jackson County, Oregon.

Borealis is most closely related to *antennatus* Motschulsky, its legs are dark and the pronotum is transverse, the pronotal and elytral fimbriae are well developed, besides it is a larger species.

Trichochrous ruficauda new species

Form small, elongate oblong-ovate and moderately convex. Color black; abdomen, legs and elytral apex and margin in apical third broadly rufous; head, pronotum and elytra with a feeble brassy luster.

Pubescence grayish, rather short and not intermixed with longer hairs; recumbent and not dense. Marginal hairs of the pronotum long, pale and bristling, not forming a regular fringe; those of the elytra shorter and more orderly.

Head rather flat between the eyes, frontal impressions broad and feeble, punctures small and sparse. Antennae stout; fifth joint wider than the preceding or succeeding joint, those beyond the fifth subequal in width, the tenth slightly wider than the others.

Pronotum very convex from side to side, declivous laterally; slightly wider than long; sides broadly arcuate in basal half and continuously so with the slightly rounded base, anteriorly less arcuate and moderately convergent to apex; apical angles obtuse, and the apex a little narrower than the base; disk finely and very sparsely punctate, intervals smooth.

Elytra about twice as long as wide, sides parallel; disk rather evenly, finely and sparsely punctate.

Abdomen very finely and sparsely punctate; surface very feebly rugulose.

Male.—Head broader and stouter. Fifth ventral abdominal segment truncate at apex, rufous in apical half with the genital segments of the same color.

Female.—Head smaller. Fifth ventral segment broadly rounded at apex. Abdominal segments pale in color, sometimes blackish in their basal half.

Measurements.—Length (type), 2.2 mm.; width, .9 mm.

Type in the collection of the California Academy of Sciences; a paratype in the author's collection.

Type locality.—Palm Springs, Imperial County, California. Collected by Mr. E. P. Van Duzee on May 20th.

Ruficauda must be associated with *antennatus* Motschulsky on account of the absence of long erect hairs and the lateral pronotal fringe not being fimbriform; the color is rather characteristic.

Trichochrous argenteus new species

Form oblong, twice as long as wide and moderately convex. Color black; tarsi piceous to rufo-piceous.

Pubescence quite dense, recumbent and luteo-argenteous in color, intermixed with short erect setae on the elytra, which become longer at the sides and apex; discal setae sparse and subserial in arrangement and pale throughout; fringe of the pronotal sides short, even and closely set.

Head small, front sparsely punctate, surface densely and finely rugulose.

Pronotum transverse, less than a half wider than long; disk moderately and evenly convex, punctures moderate in size and separated by a distance equal to two times their own diameter, intervening surface finely and feebly indentato-reticulate; base arcuate and the apex feebly arcuate; sides evenly and rather strongly arcuate in posterior half, thence almost straight and quite strongly convergent to the apical angles which are subobtuse; lateral margin not serrulate; basal angles broadly rounded and continuously so with the sides and base.

Elytra about a third longer than wide, punctures moderate, rather densely placed, the intervening surface very finely rugulose; sides feebly arcuate, margin narrowly reflexed; slightly wider posteriorly.

Abdomen rather finely and densely punctate.

Males.—More oblong, head larger, erect setae longer, pubescence somewhat coarser and more fulvous; sides of the pronotum rather more evenly and broadly arcuate from apex to base, less convergent anteriorly, apex about equal to the base, lateral margin rather narrowly explanate and arcuately reflexed. Antennae stout. Fifth ventral abdominal segment short and truncate at apex.

Female.—Fifth ventral rounded at apex.

Measurements.—Length (type), 3.4 mm.; width, 1.3 mm.

Type, male, and *allotype,* female, in the collection of the California Academy of Sciences. A paratype is in my own collection and one is to be placed in that of the American Entomological Society in Philadelphia.

Type locality.—Keen Camp, Riverside County, California. Collected by Mr. E. P. Van Duzee, on June 6 to 12, 1917.

Argenteus belongs to Casey's second group of species, those with the pubescence pale and intermixed with short sparse, erect, cinereous setae, and with the pronotal fringe even and closely set. It should follow *seriellus* Casey in the arrangement of species. *Argenteus* is more elongate, with the pubescence coarser and the head and pronotum differently sculptured; the lateral pronotal margin is explanate behind the middle and quite coarsely punctate. *Argenteus* has been very carefully compared with a specimen of *seriellus* kindly given me by Col. Casey, which came from Utah, the type locality.

Trichochrous certus new species

Form elongate oblong, parallel, about two and a half times longer than wide. Color black; tibiae toward apex and tarsi more or less rufo-piceous. Surface shining, pronotum polished. Epistomal margin and border of labrum pale.

Pubescence abundant, quite dense, almost hiding the body surface; luteo-cinereous in color, ashy on the sterna and parapleura; recumbent, with a few longer and semi-erect ashy setae on the declivous sides of the elytra; longest on the under surface of the body. Lateral pronotal fimbriae moderate in length, regular and not very closely set; elytral fimbriae longer, most so at the humeri.

Head sparsely punctate, punctures small, slightly denser anteriorly near base of the epistoma; surface smooth, feebly bi-impressed anteriorly. Eyes large and moderately prominent. Antennae rather short and stout; fourth joint triangular, fifth to the tenth quite transverse and subserrate anteriorly.

Pronotum rather transversely suboval, about a fourth wider than long; sides slightly convergent anteriorly from basal third, very feebly arcuate and not in the least explanate; apex arcuato-truncate, apical angles quite broadly rounded into the sides and apex; base broadly and distinctly arcuate, passing broadly and arcuately into the sides, which are most strongly rounded in basal third, the point of greatest width; disk evenly and rather strongly convex from side to side, evenly and sparsely punctate,

punctures small and sharp, separated by a distance equal to two or four times their diameter; surface smooth and shining throughout.

Elytra oblong, about twice as long as wide, apex broadly and evenly rounded, sutural angles rounded; disk moderately convex, quite evenly punctate, punctures small; surface smooth and scarcely rugulose toward base; humeri obtusely rounded, umbone rather large and evenly convex. Scutellum feebly transversely oblong, not strongly arcuate at apex, clothed with fine hairs.

Abdomen rather densely and finely punctate.

Male.—Narrower. Elytra not wider than the pronotum. Fifth ventral abdominal segment sinuato-truncate at apex.

Female.—Broader. Elytra slightly wider than the pronotum. Fifth ventral broadly rounded at apex.

Measurements.—Length (types), 3.2 to 4 mm.; width 1.3 to 1.6 mm.

Type, male, and *allotype*, female, in my own collection. A paratype has been deposited in the collection of the American Entomological Society in Philadelphia. All of the specimens were collected in Waterman Canyon, San Bernardino County, California, on May 27, 1916.

Certus belongs to Casey's second section of the genus. It should be placed near *mucidus* Casey. The latter species has the legs and antennae rufous.

Trichochrous subvittiger new species

Form subovate, slightly more than twice as long as wide and moderately convex. Color black, the legs rufous throughout; antennae more or less pale, fuscous beyond the middle; surface polished.

Pubescence uniform and subdecumbent, sparse, and argenteo-cinereous in color, with a subsutural vitta of blackish or brownish hairs on each elytron; the vittae are usually short or may be entirely absent. Lateral pronotal and elytral fimbriae moderate in length, regularly spaced and longer on both at base.

Head scarcely impressed, surface flat, sparsely punctate, with an impunctate area at middle just behind the epistoma; width across the eyes about equal to the pronotal apex. Antennae stout, joints five to eight serrate, equal in width and transverse; ninth and tenth, stouter and more transverse.

Pronotum rather strongly and evenly convex from side to side, apex almost equal to the length, base about a third wider than the length; sides convergent, feebly and evenly arcuate in the anterior two-thirds, more strongly so in basal third where the width is greatest; apex truncate in almost circular arc; apical angles moderately rounded; base broadly arcuate; basal angles broadly rounded with the sides; disk very sparsely punctate, interstices smooth throughout.

Elytra slightly widest posteriorly, sides straight, scarcely arcuate; apex broadly rounded, sutural angles rounded; disk sparsely and rather coarsely punctate, surface slightly transversely rugose.

Abdomen finely and rather sparsely punctate.

Male.—Rather narrower and less ovate. Fifth ventral abdominal segment evenly truncate at apex.

Female.—Broader and more ovate. Fifth ventral evenly rounded at apex, with the margin at middle clothed with brownish hairs; surface somewhat broadly flattened or very feebly impressed.

Measurements.—Length (types), 3 to 3 mm.; width, 1.2 to 1.4 mm.

Type, male, and *allotype*, female, in the collection of the California Academy of Sciences. Paratypes in the collection of the California Academy of Sciences, the author's and that of the American Entomological Society, Philadelphia.

Type locality.—San Antonio, Socorro County, New Mexico. Collected on June 22, 1921, by Mr. C. D. Duncan. Sixteen specimens studied.

Subvittiger resembles *vittiger* Casey in color and distribution of the pubescence. In *vittiger* the elytral vittae are usually well developed, although atrophic or entirely absent at times, in the latter case resembling *sparsus* Casey. In *subvittiger* the vittae are scarcely ever well developed and more often absent; the body form is different from that of *vittiger;* in the latter species the fifth ventral abdominal segment is subangulate at middle of apex in the female, and at that point quite densely clothed with brownish or blackish hairs. *Subvittiger* should follow *vittiger* in our lists.

Trichochrous niveus new species

Form elongate-oblong, a little more than twice as long as wide, moderately convex. Color black; antennae, legs and mouth-parts more or less rufo- or nigro-piceous; labrum frequently pale.

Pubescence dense, hiding the general surface, moderately long, coarse and recumbent; cinerous to flavo-cinereous in color. Intermixed toward the sides and apex with a few semi-erect or erect pale setae. Lateral marginal fimbriae of the pronotum rather short, even and quite close, increasing somewhat in length toward the basal angles. Elytral fimbriae a little longer and more widely spaced.

Head flat between the eyes, impressions broad and very shallow, separated behind the epistomal base by a slight, glabrous convexity. Very sparsely punctate.

Pronotum about a fourth wider than long, widest at posterior third; sides evenly arcuate posteriorly, thence parallel and feebly arcuate to apical third, then strongly and continuously arcuate with the apex, behind the point of greatest width, feebly convergent, straight or slightly sinuate (sometimes slightly arcuate) to the basal angles, the latter distinct, feebly prominent and obtuse to very small and scarcely discernible; base about equal to the apex, broadly arcuate at middle, oblique and straight laterally to the angles; disk moderately and evenly convex from side to side, punctures moderately small and not close, slightly denser laterally, surface scarcely asperate.

Elytra parallel, oblong, less than twice as long as wide, lateral margins narrowly explanate; sides scarcely arcuate; punctures moderately small, rather close and scarcely discernible on account of the dense pubescence; humeri slightly tumid and not broadly rounded.

Abdomen rather densely pubescent and punctate.

Male.—Sexes similar in form. Fifth ventral abdominal segment sinuato-truncate at apex and more or less slightly impressed on the disk.

Female.—Fifth ventral longer and arcuate at apex.

Measurements.—Length (types), 2.6 to 3 mm.; width, 1.2 to 1.4 mm.

Type, male, and *allotype*, female, in my own collection, and paratypes in that of Mr. Ralph Hopping, who collected the five specimens studied, on May 27, 1913.

Type locality.—Havilah, Kern County, California.

According to Casey's synoptic table *niveus* falls between *mucidus* Casey and *brevicornis* LeConte. In *niveus* the pubescence is dense and hides the general surface, the pronotum is transversely suboblong-oval and varies considerably in outline before the basal angles as indicated above. In *certus* the pubescence is shorter, less dense, not so coarse; the pronotal surface is polished; the form is usually larger and the pronotal sides are more evidently convergent anteriorly. The epipleura are moderately broad, quite horizontal and the inner margin very distinct to the apical curve; not in the least inflexed, the outer margin being less marked at the apical curve.

Trichochrous basalis new species

Form oblong and elongate, moderately convex and more or less shining. Color black; epistoma, antennae in basal half, knees, tibiae toward apex and tarsi more or less rufo-piceous at times.

Pubescence gray, rather short, moderately sparse, decumbent, with longer semi-erect hairs sparsely scattered over the elytra, especially along the sides, these are less noticeable on the pronotum. Lateral marginal fimbriae of the pronotum moderately short and rather close, becoming longer toward the basal angles; elytral fimbriae less close and slightly longer.

Head flat between the eyes, lateral impressions broad and vague, punctures sparse and moderately small; muzzle rather small with the sides convergent.

Pronotum different in the sexes.

Elytra not quite twice as long as wide; margins narrowly reflexed and somewhat evenly serrulate; disk not very convex, punctures moderately small and separated by a distance equal to two or three times their diameter.

Abdomen rather strongly, densely punctate and more or less rugulose.

Male.—Form parallel. Pronotum rather large, about a fourth wider than long, widest at the posterior fourth, sides thence rather straight to apical fourth, then rather strongly and continuously arcuate with the apex, slightly convergent in basal fourth, sinuate to almost straight before the angles, margin somewhat irregularly serrulate; apex rather truncate at middle; base about equal to the apex, arcuately lobed in middle two-fourths, thence oblique and feebly sinuate to the obtuse and distinct basal

angles; disk broadly and rather strongly arcuate from side to side, sparsely punctate, more or less asperate along the lateral margins and at the basal angles which are somewhat flattened. Fifth ventral abdominal segment short, about as long as the fourth and sinuato-truncate at apex.

Female.—Slightly wider behind. Pronotum more transverse, a little smaller; sides less prominent and sinuate behind, slightly sinuate in middle two-fourths then slightly obtusely angulate, passing arcuately into the apex; base a little broader than the apex, otherwise as in the male. Fourth and fifth ventral segments longer, the latter longer than the preceding and arcuate at apex.

Measurements.—Length (types), 3.4 to 3.5 mm.; width, 1.5 to 1.6 mm.

Type, male, and *allotype*, female, in my own collection, and paratypes in that of Mr. Ralph Hopping, who collected the specimens on June 5,1913, at an elevation of 2525 feet. Five specimens studied.

Type locality.—Isabella, Kern County, California.

The species must be placed after *fimbriatus* Casey. It differs from *niveus* in its shorter, sparser pubescence, which does not hide the general surface, and the pronotal sides are more irregular. *Basalis* is larger and more elongate, besides other differences given in the description.

Trichochrous acutus new species

Form oblong, stout, elongate and convex. Color black and shining; basal half of the femora rufous, or the legs entirely so.

Pubescence cinereous or flavo-cinereous in color, rather short and recumbent, sparse on the upper surface, dark on the central area of the pronotum and in a longitudinal stripe, that extends on each elytron to the apical declivity, nearer to the suture than to the sides and about equal to a fourth of the width of each elytron; abundantly intermixed with long, more or less erect black hairs, which are longer, erect and bristling at the sides of the pronotum and elytra, but not forming a regular and closely set fringe.

Head sparsely and moderately coarsely punctate, surface glabrous between the punctures; frontal impressions longitudinal, long and broad, the intervening surface rather convex in a rounded area behind the epistomal base. Muzzle quadrate and the epistoma long. Antennae stout.

Pronotum strongly convex, wider than long, apex about equal in width to the base; sides broadly arcuate, less so anteriorly where they become straighter, feebly and broadly sinuate behind the strongly advanced and slightly everted, acute apical angles; lateral margins rather broad and reflexed; apex deeply emarginate between the prominent angles and quite transverse in middle two-fourths; base broadly arcuate; basal angles obtuse, the margin flattened and reflexed; disk punctate, punctures moderate and sparse, slightly denser laterally.

Elytra almost twice as long as wide, oblong, rather strongly convex, slightly flattened on the disk, punctures moderate and separated by a distance equal to twice their diameter; surface slghtly transversely rugose posteriorly.

Abdomen rather finely punctate; genital segments at apex more or less set with blackish hairs.

Male.—Fifth ventral abdominal segment about a third shorter than the fourth, truncate and slightly sinuate at middle of apex.

Female.—Fifth ventral segment broadly arcuate at apex.

Measurements.—Length (types), 4 to 3.6 mm.; width, 1.7 to 1.6 mm.

Type, male, and *allotype,* female, in the collection of the California Academy of Sciences. Collected by Mr. E. P. Van Duzee on June 2. A paratype has been deposited in the collection of the American Entomological Society in Philadelphia; also, one in that of the author.

Type locality.—Soboba Springs, Riverside County, California. The species has been taken at Colton, San Bernardino County, California, May 26 and 28.

Acutus can easily be recognized by its very acute and anteriorly prominent apical angles of the pronotum, and the color and pubescence as given above; surface shining and with a somewhat purplish luster. It is related to *tinctipes*, which has a distinct purpureo-aeneous luster and obtuse apical angles which are not prominent anteriorly. The coloration is somewhat similar in the two species. Both species should follow *curticollis* Casey in our lists and cabinet arrangement.

Trichochrous dubitans new species

Form elongate, parallel to suboval and very moderately convex. Color deep black and more or less shining, surface with a very

feeble metallic tinge; antennae toward base, tibiae and tarsi more or less dark rufo-piceous.

Pubescence grayish to brownish in color, moderately long, sparse and more or less recumbent; the dark brownish hairs form a longitudinal vitta on each elytron, these extend from the base to near the apex, blending imperceptibly with the paler hairs laterally and along the suture; black semi-erect hairs are sparsely distributed on the elytra, they are of moderate length, inconspicuous, more or less decurved and not bristling. In the types these dark hairs are not discernible from the others on the pronotal disk, but more or less so on the head. Lateral pronotal fimbriae regular and moderate in length, not very closely placed and blackish in color; the fimbriae of the elytral margins are grayish and less closely placed.

Head as wide as the pronotal apex, eyes large; front flat, very feebly impressed and sparsely punctate.

Pronotum transverse, about a third wider than long; sides parallel and broadly arcuate, angles broadly rounded, the apical less strongly than the basal; apex truncate and the base broadly arcuate; disk moderately convex from side to side, very sparsely punctate in the central area where the punctures are separated by a distance equal to three or four times their diameter, denser and punctato-reticulate laterally.

Elytra about twice as long as wide, somewhat transversely impressed across the base a short distance behind the humeri; punctures not coarse and separated by a distance equal to two or three times their diameter; apex broadly rounded.

Abdomen moderately, finely and somewhat thickly punctate.

Male.—Parallel in form. Fifth ventral abdominal segment distinctly but not deeply emarginate at apex; emargination evenly rounded; surface feebly flattened at middle, pubescence not modified; longer than the fourth.

Female. –Suboval. Fifth ventral abdominal segment broadly rounded at apex.

Measurements.—Length (types), 2.9 to 3 mm.; width, 1 to 1.3 mm.

Type, male, and *allotype*, female, in the collection of the California Academy of Sciences. Collected on April 10th, 1918, by Mr. J. T. Carlson.

Type locality.—El Cajon, San Diego County, California.

Dubitans shows a beginning modification of the fifth ventral abdominal segment at apex, and therefore affinity with *sexualis* Casey; the lateral pronotal fringe is not in keeping with that of other members of the group.

Cradytes ursinus new species

Form elongate oval, two and a half times longer than wide, convex. Color black; legs rufo-testaceous; antennae piceous, basal joints somewhat rufous. Surface somewhat shining.

Pubescence rather dense but not hiding the body surface, moderately long and almost coarse and shaggy; consisting of black erect setae, and flavo-cinereous and more or less recumbent hairs, both most abundant on the head and pronotum; sides of the body not distinctly fimbriate; beneath the hairs are recumbent.

Head relatively small, a little more than half the width of the pronotum; rather coarsely and not closely punctate; antennae stout, club of seven joints which are subequal in width, fifth slightly shorter than the succeeding joints.

Pronotum a little wider than long; sides parallel and broadly arcuate, continuously so with the apical angles and apex; basal angles almost broadly rounded and subobtuse; base arcuate. Lateral margin more or less distinctly and rather coarsely dentate anteriorly; disk broadly and rather strongly convex, shining, coarsely punctate, punctures separated by a distance equal to one or two times their own diameter, sculpturing almost hidden by the long shaggy pubescence.

Elytra scarcely twice as long as wide; sides parallel, apex parabolically rounded, apices slightly dehiscent; surface rather strongly convex and coarsely punctate.

Abdomen rather densely punctate.

Male.—Prothorax somewhat larger than in the known females. Sexual characters not very evident.

Measurements.—Length (types), 4.3 to 6 mm.; width, 1.75 to 2.4 mm.

Type, male, and *allotype*, female, in my own collection. A paratype has been placed in the collection of the American Entomological Society in Philadelphia, another in that of the California Academy of Sciences, San Francisco, a third in that of Mr. F. W. Nunenmacher and one in my own.

Type locality.—Nogales, Arizona. Collected by Mr. F. W. Nunenmacher, on Sept. 4. 1906.

The species is obviously not *serricollis* LeConte; *longicollis* Casey has the erect setae pale and the legs black; *serrulatus* LeConte has the legs black and differs in other particulars as well. *Ursinus* may possibly prove to be a race of the latter species. The other species are before me.

The four species of *Cradytes* may be recognized as follows:

Body black, elytra pale rufo-ferruginous . . 1. *serricollis* LeConte
Body black throughout; legs black or pale; smaller species.
  Erect setae of elytra pale; legs black. . . . . 2. *longicollis* Casey
  Erect setae black; body very slightly stouter.
    Legs black; pubescence very short . . . 3. *serrulatus* LeConte
    Legs rufo-testaceous; pubescence long and shaggy. 4. *ursinus* new species

NOTES ON THE GENUS PIPIZELLA RONDANI, WITH DESCRIPTIONS OF NEW SPECIES

(DIPTERA; SYRPHIDAE)

BY C. HOWARD CURRAN

Since my revision of the Pipizini[1] considerable material has come to hand and specimens compared with Walker's types in the British Museum by Major E. E. Austen have been returned. I wish to express my appreciation to Major Austen for his kindness in making the comparisons and for clearing up certain questions of synonymy. An examination of all the North American types except *occidentalis* Townsend, which may not be a *Pipizella*, and the type of which is destroyed, also leads to the necessity for further changes. I believe that there can be no further confusion with regard to the limitation or identity of our described species, and herewith submit a revised table of species, which it is hoped may prove of assistance in determining specimens.

I do not see that there should be any confusion regarding the limits of the genus *Pipizella* in North America. The species are all homogeneous and do not run into either *Heryngia* or *Cnemodon*, and certainly not into *Pipiza*. It is not to be expected that one may be able to determine every specimen accurately without a knowledge of several species, or a large collection. Local collections are always most confusing and in the *Pipizini* often almost impossible to determine. So many undescribed species of *Pipizini* have come to light since my revision that it is evident, notwithstanding the large number of species described, there are still almost as many more to be added to our lists by further collecting.

The genus *Trichopsomyia* Williston (South America) is very closely allied to *Pipizella*, but the patchy pilose eyes at once distinguish it.

[1] Calif. Acad. Sci., 4th ser., XI, p. 347, etc.

Table of Species

1. Hind tarsi wholly blackish 2
   Hind tarsi with one or two joints yellow 4

2. Posterior tibiae wholly black pilose; femora chiefly black pilose; face black pilose, at least below . . *rufithoracica* Curran
   Posterior tibiae white pilose behind; femora chiefly pale pilose; face wholly pale pilose 3

3. Apical cross-vein curved near its middle; face more perpendicular below, distinctly slightly swollen on middle portion; discal cross-vein straight, somewhat oblique in ♂, rectangular or slightly recurrent in ♀ . . *nigritarsis* new species
   Apical cross-vein angulated at basal third; face without any swelling, almost evenly retreating, but not quite so evenly below; discal cross-vein curved moderately outward at middle . . . . . *similis* new species

4. Front wholly white pilose; the spurious vein extends scarcely beyond the anterior cross-vein (♀) . . *occidentalis* Townsend[2]
   Front almost always with a blackish pilose band across the ocellar triangle in ♀. Front of ♂ partly black pilose . . 5

5. Hind basitarsus wholly white pilose; eyes of ♂ narrowly contiguous . . . . . *pubescens* Loew
   Hind basitarsus black pilose above; eyes of ♂ rather broadly contiguous or separated 6
6. Wings with a large brown cloud in the middle (Mexico). *bellula* Williston[2]

   Wings rather evenly brownish or hyaline 7

7. Wings distinctly brownish yellow; face and front metallic blue; front of ♀ distinctly narrowed above; eyes of ♂ distinctly separated; third antennal joint four times as long as broad . . . . . *australis* Johnson
   Wings slightly brownish or pure hyaline, the third antennal joint not over three times as long as broad 8

8. Frontal triangle broadly opaque above, the lower margin angulated, yellow joints of the tarsi wholly without black hairs or bristles; pile on hind basitarsi very long and prominent . . . . . *banksi* Curran
   Frontal triangle scarcely opaque above, if opaque its lower margin transverse, at least apices of tarsal segments with black bristles above 9

[2] Not seen and relationship within genus not known.

9. Hind tibiae always wholly black pilose; the middle basitarsus bears a double row of short black hairs above for its entire length (*pulchella* Williston, *modesta* Loew, *nigribarba* Loew)..... *apisaon* Walker[3]

Hind tibiae sometimes with many white hairs on outer surface, but frequently wholly black pilose; middle basitarsi wholly with yellow hairs except apically; third antennal joint often wholly black (*fraudulenta* Loew). *recedens* Walker[3]

Pipizella nigritarsis new species

Allied to *P. rufithoracica* Curran, but the thorax is wholly whitish pilose, the apical cross-vein is bent at the basal third and the third antennal joint is a little wider sub-apically.

Length, 5.5 to 6 mm. *Male.* Face shining black, moderately retreating with a gentle swelling on the upper three-fourths; with moderately long, rather coarse black pile, the middle with some white hairs. Frontal triangle metallic greenish black, smooth, convex, with longer black pile than that on the face. Narrow orbital margins of face and front silvery white pollinose. Vertical triangle greenish black, with long pale pile, a few black hairs in front. Occiput shining greenish black, the orbits on the lower two-thirds greyish white pollinose; pile whitish or faintly yellowish; the orbital ciliae long, black. Eyes with rather long pile which does not leave a semi-bare stripe, brownish; more yellowish below. Antennae black, third joint obscurely reddish below at base; twice as long as wide, its sides nearly parallel, but the joint widest at apical third, thence tapering to the rounded apex. Arista brown, its basal half reddish. Eyes touching for the length of vertical triangle.

Thorax metallic greenish black; moderately long whitish yellow pilose, the hairs not wavy. Scutellum concolorous, with shallow apical groove and similar pile.

Legs shining black, with yellowish white pile; which is longer on the hind tibiae, but everywhere rather sparse; narrow apices of front four femora, narrow base of hind and nearly the basal half of the front four tibiae and their apices obscurely, and first joint of front four tarsi, yellow or reddish yellow; second joint of front four tarsi fuscous. Hind basitarsi slightly incrassate, their tibiae slightly arcuate apically.

[3] These two species are very close but the former is more robust, the abdomen broader and less acute, the hair on the hind basitarsi is more conspicuous. The females will not separate out by the key, but that sex of *apisaon* has the first joint of the front tarsus always yellow, while in *recedens* it is brown, only the tip yellow.

Wings lightly brownish, stigma brownish. Last section of fourth vein curved outward just before its middle, its basal section a little oblique, the discal cross-vein straight, moderately oblique. Halteres yellow.

Abdomen metallic blackish blue, the apices of the segments moderately broadly, black. Pile black and white as usual. Genitalia black, with pale pile.

Female.—Face almost evenly retreating, just a trace of the swelling; wholly white pilose. Front slightly narrowed above, the lateral pollinose stripe expanded into a small triangle at the middle of the front; pile rather long, white, black just above the antennae and a broad band across the ocellar triangle. Occipital ciliae and pile all whitish. Third antennal joint sometimes reddish at base below.

Pile of thorax yellowish white. Wings rather paler, but still slightly fuscous. First joint of front tarsi not yellow.

Abdomen shining black, short white pilose, the rather narrow apices of the segments with black pile, the base of the fourth segment narrowly black pilose.

Holotype.—♂; Moscow Mountain, Idaho, July 9, 1920, (A. L. Melander), in Dr. Melander's Collection.

Allotype.—♀; Avon, Idaho, June 26, 1912; in Dr. Melander's Collection.

Paratype.—♀; Yellowstone National Park, Wyoming, July 12, 1918, (Melander); in my collection.

Pipizella similis new species

Female.—Very similar to the preceding, but the face lacks any swelling, the apical cross-vein is angulated at its apical third and the black pile on the abdomen does not reach the sides. The face is not perpendicular just above the oral margin as in the preceding, and the last section of the fifth vein (discal cross-vein), is curved at its middle.

Holotype.—♀; Lake McDonald, Glacier Park, Montana, August 14, 1916, (A. L. Melander); in Dr. Melander's Collection.

Pipizella apisaon Walker

Walker described *Chrysogaster apisaon* from New York, the same locality as both *modesta* Loew and *nigribarba* Loew. Loew failed to recognize the species probably because of its being placed in *Chrysogaster*. A male specimen of *modesta*

was compared with the type of *C. apisaon* by Major Austen and was pronounced identical, except that the hair on the upper portion of the eyes and on the extensor surface of the hind tarsi is shorter in my specimen. An examination of the series in my collection shows sufficient variation in the characters mentioned to prove that the males (*nigribarba* Loew and *apisaon* Walker) are conspecific and that Walker's name should therefore be used for this species instead of either of those proposed by Loew. *Pipiza pulchella* Williston is also a synonym of *apisaon* as shown by an examination of the type in the United States National Museum. Williston suspected that his species was *apisaon*.[4]

Pipizella recedens Walker

This species, described as *Chrysogaster recedens* by Walker in "Diptera Saundersiana," with the broad locality of "United States," was probably from New England. Specimens of *Pipizella fraudulenta* Loew, which were compared with Walker's type, were considered by Major Austen as probably being the same species, but as the type is not in good condition Major Austen states that—"It is by no means easy to draw definite conclusions from a comparison of specimens with it." He further states that *Paragus transatlanticus* Walker, an older name, is probably the same species, but Walker included a *Paragus* and *Heryngia*, the latter of which would be *Pipizella* as I have limited the genus. Walker's later name therefore has priority. It would seem that there is little question about the specimens under discussion being conspecific, and in order to clear up the synonymy I propose that Walker's name *recedens*, be used for the species treated in my revision as *fraudulenta* Loew. My specimens agree with Loew's type in the Museum of Comparative Zoölogy, Cambridge.

Pipizella banksi Curran

The male of this species has not been described and the description is given herewith. In my revision of the genus I gave this species sub-specific rank under *P. pulchella* Williston, but an examination of the type of that species shows that the present one is quite distinct, and that Williston's species is the

[4] See Synopsis No. Amer. Syrphidae, p. 291.

same as what I had considered *P. modesta* Loew, which is a synonym of *Pipizella* (*Chrysogaster*) *apisaon* Walker.

The male differs from the female as follows: Frontal triangle large, flattened, a little prominent above; broadly opaque along the orbits on upper third; black pilose along the orbits, white elsewhere; eyes touching for a distance slightly greater than the distance between the anterior and posterior ocelli. Vertical triangle yellowish greyish pilose, a few black hairs anteriorly; occipital ciliae fine, black, except at vertex; first two antennal joints piceous yellowish (usually similar in ♀), the third slightly shorter.

Thorax rather abundantly short, bright yellow pilose; on anterior half of the mesonotum on either side of the middle line with a moderately broad greyish yellow stripe, the stripes slightly divergent behind: in some lights they reach to the posterior fourth; the ground color is blue black, with faint indications of metallic blue in some lights, especially along the vittae. Scutellum rather large, densely finely punctured, shining black, with similar pile to mesonotum.

Pile of legs moderately long, pale yellowish, the hind femora with black hair above at apex; hind tibiae beneath and behind with short black hair; on the apical third in front and apex externally, with long black hair, elsewhere with long pale hair. Hind basitarsi with black hair above, the pale joints with white hair. (The pile on the legs of the ♀ is similar but white instead of yellow and perhaps the pale pile is a little more extensive.)

Wings hyaline, the apical cross-vein curved just beyond its basal third. (In the ♀ it is curved at its middle.)

Abdomen rather brassy black, the disc with a slight opaque covering, the usual areas shining black. Black and pale pile as usual, the pale pile yellowish, the black not reaching the margins as a rule.

I here designate a male taken in copula,—Lawrence, Kansas, June 9, 1922, (Curran)—as the allotype. This specimen is in my collection.

The description is drawn from thirty-four male specimens, all from Kansas, and includes another pair taken in copula, on June 15. I found the species very abundant on bloom and on foliage near by. It evidently has an extensive range.

Pipizella australis Johnson

I possess a paratype of this species, only the female of which was described. The male is remarkable owing to its very long, flat front and narrowly separated eyes.

The male does not differ greatly from the female in most respects. The salient characters are here given: Face retreating, the slight swelling occupying more than the middle of the face and a little more prominent above. Frontal triangle long, plane, not prominent above, wholly shining bluish, not opaque above, the orbits on lower half narrowly white pollinose. Eyes approaching closest about twice the width of the anterior ocellus in front of it and separated by about the width of that ocellus. Vertical triangle and upper third of frontal triangle with long sparse black pile. Occiput wholly black haired. Third antennal joint narrowly reddish on basal third below; four times as long as wide. Arista dull reddish on basal half.

Thorax and scutellum blue black, shining, short white pilose.

Legs blackish, narrow apices of front four femora, base of hind and basal third or more and apices of front four tibiae, first two joints of front, first three of middle, second and third of hind and tip of first joint of hind tarsi, yellow. Pile all black except on the pale tarsal joints where it is white.

Wings as in female.

Abdomen blue black, the first segment and lateral margins metallic blue, the usual areas more blackish, the pile whitish, with the usual areas black. Genitalia and margins of fourth segment rather piceous, the former with rather long, sparse white pile.

The male is from Galveston, Texas, June, 1900, and was forwarded by Dr. Melander for determination.

THE CHAMBERS SPECIMENS OF TINEINA IN THE COLLECTION OF THE AMERICAN ENTOMOLOGICAL SOCIETY

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Chambers distributed from time to time, to various institutions and individuals, specimens of his species. Certain of these, bearing Chambers' written labels, are recognized as his types and are thus labeled in the collections. Other specimens, also labeled by Chambers, are found in several of the collections. Although the status of these specimens may not be that of type, their value in clearing up disputed points is evident, especially when there are no other authentic specimens. In such cases they may at least be assumed to represent his conception of the species, unless there is obvious error or carelessness in labeling or his description forbids the assumption.

Of the latter character may be regarded a set of specimens presented to the American Entomological Society of Philadelphia. Specimens were sent in 1872 and in 1877 respectively. The specimens, which are the subject of this paper, were received in pill boxes, probably in 1872, as may be inferred from Chambers' note at the end of his written list accompanying the specimens, the dates of publication of the species, and occasional published remarks, particularly his statement under the description of *Argyresthia undulatella* (1874), that specimens had been distributed under other generic names.

The list, immediately following, is a copy (repeating the misspellings of the original) of the written list in Chambers' handwriting,[1] which accompanied the specimens.

[1]Where quoted the list of Chambers here given is exactly as written by him. On account of the limitation of type composition the generic names and "Mihi" are not dittoed for their repetition, as in the original, but filled out in each case, and the actual list of names is, therefore, not given as a facsimile quotation.—[Ed.]

"List of Tineina Sent to the Cabinet of The American Entomological Society"

No. 1 *Tinea aurisuffusella* Mihi
2 *Tinea auripulvella* Mihi
3 *Tinea auristrigella* Mihi
4 *Cyane visaliella*—g. & sp. nov. Mihi
(5 omitted by mistake)
6 *Gelechia thoraceochrella* Mihi
7 *Gelechia difficilisella* Mihi
8 *Gelechia tephriasella* Mihi
9 *Gelechia badiiella* Mihi
10 *Gelechia physaliella* Mihi
(11 omitted by mistake)
12 *Gelechia thoracealbella* Mihi
13 *Gelechia palpiannulella* Mihi
14 *Gelechia variiella* Mihi
15 *Gelechia discoocella* Mihi
16 *Agnippe biscolorella* g. & sp. nov. Mihi
17 *Bedellia somnulentella* Mihi
18 *Sinoe ambrosiaeella* Mihi
19 *Coleophora lineapulvella* Mihi
20 *Nepticula serotinaeella* Mihi
21 *Nepticula clemensella* Mihi
22 *Nepticula maximella* Mihi
23 *Cyllene minutisimella* Mihi
24 *Polixo undulatella* Mihi
25 *Clymene aegrefasciella* Mihi
26 *Lithocolletis hamadryadella* Clem.
27 *Lithocolletis tritaeniella* Mihi
28 *Lithocolletis helianthivorella* Mihi
29 *Lithocolletis caryaefoliella* Clem.
29½ *Lithocolletis corryliella* Mihi
30 *Lithocolletis ulmella* Mihi
31 *Lithocolletis robiniella* Clem.
32 *Lithocolletis ambroseaeella* Mihi
33 *Lithocolletis crataegella* Clem.
34 *Lithocolletis ornatella* Mihi
35 *Lithocolletis celtisella* Mihi

36 *Lithocolletis lucidicostella* Clem.
37 *Lithocolletis basisirigella* Clem.
38 *Lithocolletis clemensella* Mihi
39 *Lithocolletis lucetiella* Clem.
40 *Lithocolletis quercibella* Mihi
41 *Lithocolletis caryaealbella* Mihi
42 *Lithocolletis saundersella* Mihi
43 *Lithocolletis unifasciella* Mihi
44 *Lithocolletis fuscocostella* Mihi
45 *Lithocolletis salicifoliella* Mihi
46 *Lithocolletis bethuniella* Mihi
47 *Phyllocnistis liriodendronella* Clem.
48 *Phyllocnistis populiella* Mihi
49 *Phyllocnistis vitifoliella* Mihi
50 *Phyllocnistis ampelopsiella* Mihi
51 *Cemiostoma albella* Mihi
52 *Tischeria malifoliella* Clem.
53 *Tischeria tinctoriella* Mihi
54 *Tischeria zelleriella* Clem.
55 *Tischeria badiiella* Mihi
56 *Tischeria heliopsiella* Mihi
57 *Bucculatrix obscurifasciella* Mihi
58 *Bucculatrix luteella* Mihi
59 *Gracillaria salicifoliella* Mihi
60 *Gracillaria purpuriella* Mihi
61 *Gracillaria* (*Parectopa*) *robiniella* Clem.
62 *Gracillaria juglandisinigraeella* Mihi
63 *Gracillaria packardella* Mihi
64 *Gracillaria plantaginisella* Mihi
65 *Gracillaria albinotella* Mihi
66 *Lithocolletis tiliaeella* Mihi
67 *Lithocolletis cincinnatiella* Mihi
A—*Yponomeuta orbimaculella* Mihi
(This is no doubt the European *Y. evonymella*)
B—*Yponomeuta longimaculella* Mihi
C—*Ypsolophus caryaefoliella* Mihi
D—*Depressaria* ? *pseudaccaciella* Mihi
E—*Depressaria* ? (*Gelechia*) *cercerisella* Mihi
F—*Cyrrha platanella* Mihi

G—*Depressaria* ? *bicostomaculella* Mihi
H—*Depressaria* ? *obscurusella* Mihi
I—(error)
K—*Hagno cryptolechiella* Mihi
L—*Corycia costolutiella* Mihi
M—*Depressaria* ? (*Gelechia*) *bimaculella* Mihi
N—*Adiasteia alexandriella* Mihi

"The descriptions of some of these species have not yet been published; they are however, prepared and some of them are in the hands of the printers."

Of the species in this list, numbers 7, 13, 16, 17, 21, and 60, and A to N inclusive are missing.

As will have been noticed from the list, some of the specimens are examples of Clemens' species. These, except No. 54, which is wrongly identified, are not mentioned in this paper.

Most of the Chambers species are represented by "types" elsewhere, but our knowledge of a few of the species is advanced through a study of these specimens. Many of the specimens are in poor condition, wings only, and in some instances, mere fragments. There are several examples of Chambers' well-known carelessness in identifying and labeling his specimens, and variation in spelling his own specific names.

The locality of *Gelechia thoracealbella* is given as Texas, in Chambers' original description. All of the other species were described with "Kentucky" as the only locality given in most instances. It may reasonably be assumed that these specimens are all Kentucky specimens.

No. 1. *Tinea aurisuffusella* Chambers. This is a representative of the species known under Clemens' earlier name, *Hybroma servulella.*

No. 2. *Tinea auripulvella* Chambers. This specimen is not Chambers' *Tinea auropulvella*, but is a male of *Tinea acapnopennella* Clemens, which Chambers did not recognize and separate from his own species, as shown by the fact that among the types of *T. auropulvella* in the Museum of Comparative Zoölogy are also specimens of *T. acapnopennella* Clemens.

No. 3. *Tinea auristrigella* Chambers. This is an example of the well-known *Isocorypha mediostriatella* Clemens, of which Chambers' name is a synonym.

No. 4. *Cyane visaliella* Chambers. The specimen consists of wings only, badly denuded, but recognizable as representing Chambers' species.

No. 6. *Gelechia thoraceochrella* Chambers. This species, of which no other authentic specimen is in existence, is here represented by a specimen easily recognized as a true *Gelechia*, although it consists of wings only, the right fore wing in perfect condition, the other wings somewhat damaged. A small piece of the thorax shows it to be ocherous, marked with shaded patches of dark brown, not uniformly reddish ocherous, as would be inferred from Chambers' description. The following description of the wing is given as an aid in identification.

Fore wing dark brown, with a faint rusty tinge (which may however be due to the age of the specimen), somewhat dusted with ocherous scales, which form an indistinct angulated fascia at the apical third, and marked with darker brown spots of which the most clearly defined are the following: a spot near base; a spot at basal third of costa connected with a spot in the cell, and this in turn with a more longitudinal spot in the fold, this last being edged before and behind with ocherous scales; a faint oblique shade from middle of costa, and just before it on the disk, a darker brown spot, followed by ocherous scales; a smaller brown spot beyond this, edged internally with ocherous; a dark brown shade defines the inner edge of the fascia on the costa and on the dorsum. Beyond the fascia three indistinct ocherous costal spots. Cilia brown, their extreme tips ocherous. Length of wing, 6.5 mm.

As this is the only known Chambers specimen of the species, it may be designated as the type of the species.

The species belongs to the *gilvomaculella* group, but is darker, more brownish, and has the markings less sharply defined than the other recognized species of that group.

I have seen no other specimen exactly like this one.

No. 8. *Gelechia tephriasella* Chambers. One female specimen, wings and body in perfect condition, but only the basal segments of the antennae, and half of the second segment of one labial palpus intact. The species should be known as *Anacampsis tephriasella*, as shown by the form of the hind wings and the smooth second segment of the labial palpi.

As this specimen is apparently the only Chambers specimen of the species which is sufficiently well preserved to show the generic characters, it is here designated as the type of the species.

The species is easily recognized by the peculiar markings of the antennae. A large series of specimens in my own collection uniformly show this character, but vary in expanse (8–13 mm.), depth of color and sharpness of marking. The expanse of this "type" is 11 mm. As a general rule the smaller specimens show the sharpest contrast between ground color and markings. The third segment of the palpi would better be described as whitish, with dark dusting, a black annulus beyond middle, and extreme tip black. Chambers' description of the wing is inadequate, and the following description, made from the type, will supplement it.

Fore wings pale gray and white, mingled with darker fuscous scales, each of these latter tipped with white; the ground color deepens to the fascia which is thus rather sharply defined on its inner edge. This fascia is doubly curved, almost convex inwardly in its costal half, concave inwardly in its dorsal half and reaches the margin considerably nearer the tip at its dorsal extremity. A blackish spot at extreme base of costa, a second at basal fourth, a third at middle of costa; just beyond each of the last two spots the costa is whitish; a series of three rather small dots in a line through the cell, the last two close together; two similar dots beneath the fold; two elongate spots in the apex of the wing. Hind wings dark brown.

In darker specimens the spots on the disk are not clearly defined, and occasionally the elongate spots in the apex, at least one of them, are almost wanting.

The specimens in my own collection were captured in May, June and July.

No. 9. *Gelechia badiiella* Chambers. The two specimens thus labeled on the pill box and referred to under the same name in the list, are nothing more than examples of *Recurvaria variella* Chambers. The name "Gelechia badiiella" was never published, and this is apparently but an instance of Chambers' carelessness in distributing his "types," or his failure to recognize these specimens as identical with his *Gelechia variella*, sent correctly determined as No. 14 of the list.

No. 10. *Gelechia physaliella* Chambers. What remains of this specimen shows that it truly represents the species now known as *Aristotelia physaliella*.

The species is by no means common. I have reared a small series of specimens from larvae collected May 28 in Powell

County, Kentucky, on young plants of an undetermined species of *Physalis*. The leaves of this plant are thin in texture, and the character of the mine is different from that described by Chambers in leaves of *Physalis viscosa*. The mines are at first linear and contorted, later blotch-like, with most of the leaf substance consumed.

No. 12. *Gelechia thoracealbella* Chambers. The fragments of this specimen are insufficient to add anything to our present knowledge of the species. I doubt if this specimen even represents the species.

No. 14. *Gelechia variiella* Chambers. This is the well-known bald cypress feeder, now placed in the genus *Recurvaria*.

No. 15. *Gelechia discoocella* Chambers. The pill-box label gives the additional variation "discoocelella." The specimen, consisting of wings only, is an undoubted example of the well-known *Gelechia discoocellella*.

No. 18. *Sinoe ambrosiaeella* Chambers. The pill-box label gives the name as *Sinoe ambrosiaeella*, and the part of one hind wing and one fore wing shows that this specimen, as in the case of other specimens sent out by Chambers under that name, is *Scythris impositella* Zeller.

No. 19. *Coleophora lineapulvella* Chambers. In the Museum of Comparative Zoölogy at Cambridge, Mass., is a series of Chambers' types, not all of the same species, but the first specimen of the series, and some of the others, are identical with this specimen in the collection at the Academy at Natural Sciences in Philadelphia and are examples of the species subsequently described by me as *Coleophora amaranthella*;[2] on the strength of this evidence *amaranthella* must sink as a synonym of *lineapulvella*.

In spite of the obvious identity of these type specimens with the amaranth-feeder, the suspicion arises that the original specimen from which Chambers prepared his description was of a different species. My reasons for this suspicion are three-fold: (1) the smaller size given for *lineapulvella*, (2) Chambers' failure to mention the distinct spot at the lower angle of the cell, which, it is true, might have been rubbed off in his specimen, (3) the

[2] Ent. News, xxx, p. 129, (1919).

date of capture of *lineapulvella*, June 21st, which is five weeks earlier than the earliest record I have for *amaranthella*. This date almost precludes the possibility of the identity of the two, as amaranth does not bloom until August, and the moths of seed-feeding species appear coincidently with the blooming of the food plant.

No. 20. *Nepticula serotinaeella* Chambers. This is a specimen, in excellent condition of the common wild cherry miner, known by Clemens' earlier name, *Nepticula bifasciella*.

No. 22. *Nepticula maximella* Chambers. Three specimens, all females, and without doubt representing Chambers' species, which is the same as *N. platanella* Clemens. In all three, the opposite costal and dorsal spots are large, in one specimen, forming a complete fascia, in another just meeting.

No. 23. *Cyllene minutisimella* Chambers. This species, of which nothing now remains, is a member of the Trichopterous family Hydroptilidae, as Chambers himself subsequently decided.

No. 24. *Polixo undulatella* Chambers. Four specimens, three of them good, easily recognizable as examples of *Argyresthia undulatella*. Chambers remarks at the time of describing the species[3] that he had not formerly recognized it as an *Argyresthia* and that specimens had been distributed "under the names *Polyxo undulatella* and *Albunea undulatella*." The latter name in this case is written on the pill box.

No. 25. *Clymene aegrefasciella* Chambers. This Chambers recognized later as a Trichopterous insect.

Nos. 26 to 46 are, with a few exceptions, examples of species of *Lithocolletis*, for the most part common and well-known, and represented elsewhere by authentic types.

No. 27. *Lithocolletis tritaeniella* Chambers. The spelling, *tritaenianella*, which appears on the pill box, has priority. The specimen consists of fore wings only.

No. 28. *Lithocolletis helianthivorella* Chambers. The specimen, consisting of fore wings only, agrees with Chambers' types at Cambridge. Frey and Boll's earlier name, *ignota*, takes precedence. The species is now placed in the genus *Cremastobombycia*.

[3] Can. Ent., VI, p. 10, (1874).

No. 29½. *Lithocolletis corryliella* Chambers. An obvious misspelling in the list for *coryliella*, as the name appears on the pill box. The further misspelling, *corylisella*, unfortunately has priority. Four specimens, one in fine condition. This species, which is very close to *ostryarella*, is best separated from that species by the fact that the white dorsal streak at the tornus is more nearly erect and never forms a continuous line with the streak in the apex.

No. 30. *Lithocolletis ulmella* Chambers. In so far as can be determined from the condition of the specimen, of which only part of one pair of wings remains, it is an example of this species.

No. 32. *Lithocolletis ambrosiaeella* Chambers. The species is now known as *Cremastobombycia ambrosiella* Chambers.

No. 34. *Lithocolletis ornatella* Chambers. Fitch's earlier name, *ostensackenella*, has priority.

No. 35. *Lithocolletis celtisella* Chambers. Two specimens, wings only, but these easily recognized as examples of the species.

No. 38. *Lithocolletis clemensella* Chambers. One specimen.

No. 40. *Lithocolletis quercibella* Chambers. This is a fine specimen of the species known under Fitch's earlier name, *quercialbella*.

This specimen is here designated as the type of *Lithocolletis quercibella* Chambers.

No. 41. *Lithocolletis caryaealbella* Chambers. One specimen, which agrees exactly with the type at Cambridge. A much rarer species than *olivaeformis* Braun, also a miner of hickory.

No. 42. *Lithocolletis saundersella* Chambers. The pill box bears the inscription "L. saundersella." This is *Leucanthiza amphicarpeaefoliella* Clemens, which Chambers described as *Leucanthiza saundersella*.

No. 43. *Lithocolletis unifasciella* Chambers. The wings, in excellent condition, show this to be a typical example of the species; the name *fasciella* Walsingham replaces Chambers' preoccupied name.

No. 44. *Lithocolletis fuscocostella* Chambers. The specimen is in poor condition, but as well as can be determined it is an example of Chambers' *fuscocostella;* the name is a synonym of *argentifimbriella* Clemens.

No. 45. *Lithocolletis salicifoliella* Clemens. Nothing remains of the specimen of this species of which Chambers was the first to describe the imagoes.

No. 46. *Lithocolletis bethuniella* Chambers. One specimen.

No. 48. *Phyllocnistis populiella* Chambers. One specimen in recognizable condition.

No. 49. *Phyllocnistis vitifoliella* Chambers. Three specimens, two in perfect condition.

No. 50. *Phyllocnistis ampelopsiella* Chambers. The wings of this specimen show clearly the fuscous basal streak which characterizes this species.

No. 51. *Cemiostoma albella* Chambers. Two specimens of this widely distributed species which is now placed in the genus *Proleucoptera* Busck.

No. 53. *Tischeria tinctoriella* Chambers. This is a synonym of *Tischeria quercitella* Clemens. *Tischeria quercivorella* Chambers is a synonym of *T. citrinipennella* Clemens.

No. 54. *Tischeria zelleriella* Clemens. This is not an example of Clemens' species, now known as *Coptotriche zelleriella* Clemens. Chambers, in his earlier work, identified as *T. zelleriella*[4] a species to which he later[5] gave the name *clemensella.* It might be expected that this specimen would prove to be that species, but, however, such is not the case. The specimen as far as can be determined from its rubbed condition is a female *citrinipennella.* The true *clemensella,* which is represented in the Museum of Comparative Zoölogy by the hind wing of a male, is a very different thing. The species exhibits a remarkable sexual dimorphism, the female, as Chambers remarks, resembling the female of *Coptotriche zelleriella* Clemens; the male being much paler and characterized by the greatly broadened basal half of the hind wing.

[4] Cin. Quart. Jn. Sci., II, p. 110, (1875).
[5] Bull. U. S. Geol. Surv. Terr., IV, p. 99, (1878).

No. 55. *Tischeria badiiella* Chambers. The specimen is not an example of this species, agreeing neither with Chambers' type at Cambridge nor with his description. It is a specimen of *Tischeria nubila* Braun, which makes a very similar mine. Chambers evidently reared both species together and did not always discriminate between them.

No. 56. *Tischeria heliopsiella* Chambers. The specimen, consisting of one perfect fore wing and parts of wings, represents this species; the spelling of the specific name on the pill box and in the published description is *heliopsisella*.

No. 57. *Bucculatrix obscurifasciella* Chambers. Chambers' species is a synonym of Clemens' *trifasciella*. The specimen, in excellent condition, is a male of this well-known species.

No. 58. *Bucculatrix luteella* Chambers. This specimen, consisting of wings only, undoubtedly represents Chambers' species, *luteella*, and agrees with the types in the Museum of Comparative Zoölogy. The patch of raised scales on the dorsal margin varies in size. It is sometimes entirely absent, as it is in this specimen, and in one of the type series at Cambridge.

The species is an oak feeder.

No. 59. *Gracilaria salicifoliella* Chambers. Two specimens. The species is now placed under *Parectopa*.

No. 62. *Gracilaria juglandisinigraeella* Chambers. Of this specimen but a small part of one fore wing remains. It is the species in our lists under Chambers' earlier name, *juglandiella*.

No. 63. *Gracilaria packardella* Chambers. One specimen in fair condition, of this common maple feeder.

No. 64. *Gracilaria plantaginisella* Chambers. Two specimens, one in unusually perfect condition, of this very distinct species, which is a common miner in leaves of *Erigeron*. It is now placed under the genus *Parectopa*.

No. 65. *Gracilaria albinotella* Chambers. One specimen, consisting of the right pair of wings, of this easily recognized species. It was described as *Gracilaria* (*Coriscium ?*) *albinatella*. The species is now placed under *Acrocercops*.

No. 66. *Lithocolletis tiliacella* Chambers. One specimen, without abdomen. The name is written on the pill box "tiliaeella."

No. 67. *Lithocolletis cincinnatiella* Chambers. Two specimens of this very common oak-feeding species.

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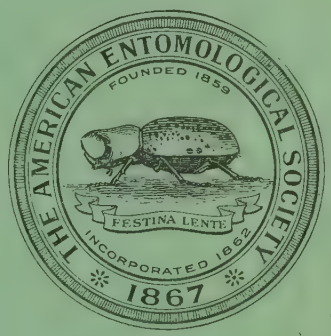

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